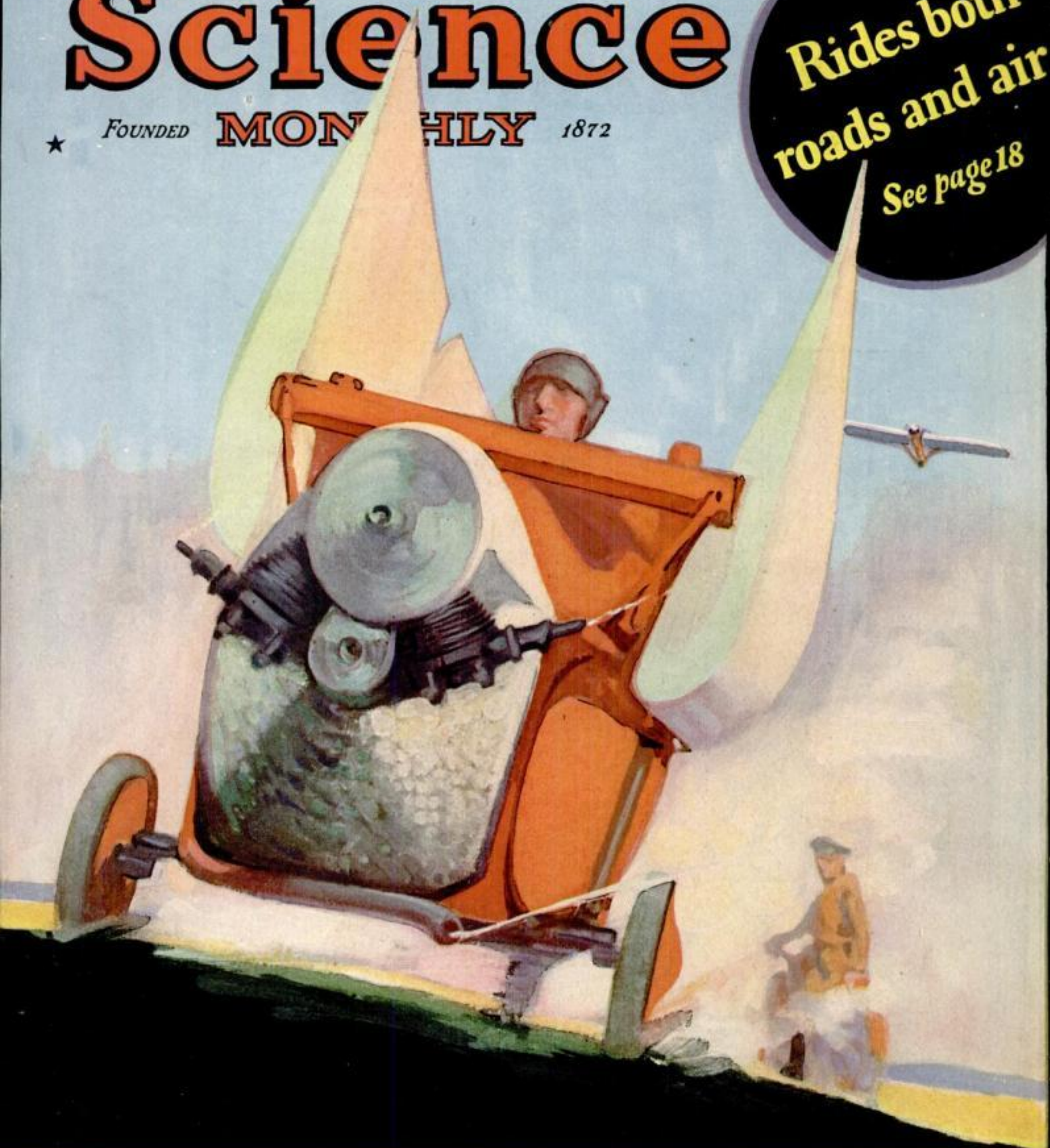


Popular Science

★ FOUNDED MONTHLY 1872

Rides both
roads and air
See page 18



\$1,000 IN CASH PRIZES EVERY MONTH

MARCH

See Page 11

25 CENTS

Copyrighted material

This better hammer *keeps* better

YOU can buy a Plumb Hammer today that will keep new for years.

It will retain its balance, its accuracy, its power — the things that make it famous—for its head will stay tight at a turn of your wrist on the Take-Up Wedge.

Everything you want in a hammer — permanently. Such as a larger face for greater accuracy; a shorter neck for better balance, more power; knife-edge claws

that pull any nail with ease.

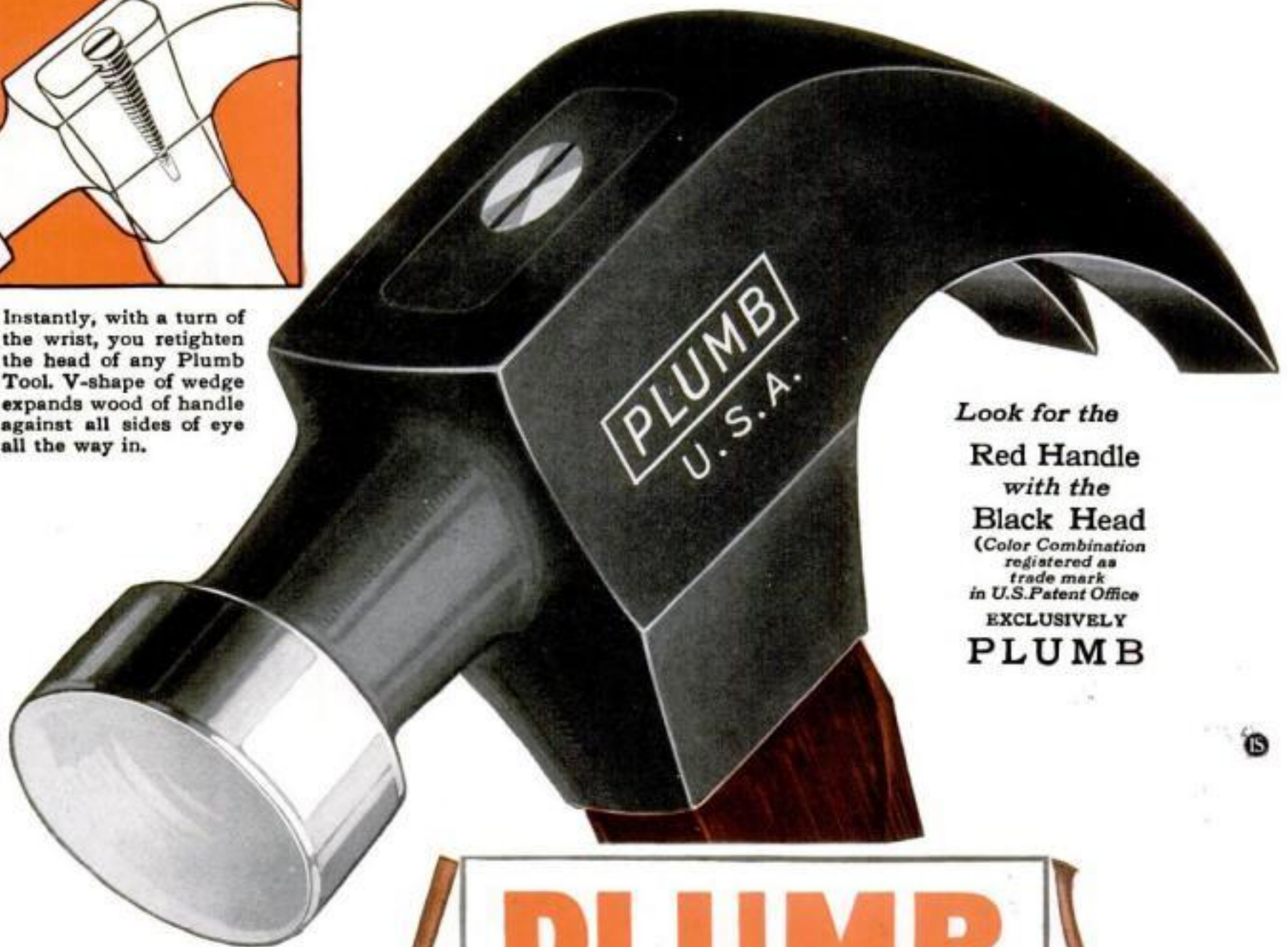
This is the hammer that hundreds of carpenters helped to design, the tool whose long life and skillful service make it the right hammer for every man who wants to do good work easily.

The hardware dealer who sells you a Plumb Hammer, or other Plumb Tool, wants to give you — *does* give you—all the value your money can buy.

FAYETTE R. PLUMB, Inc., Philadelphia, U. S. A.



Instantly, with a turn of the wrist, you retighten the head of any Plumb Tool. V-shape of wedge expands wood of handle against all sides of eye all the way in.



Look for the
Red Handle
with the
Black Head
(Color Combination
registered as
trade mark
in U.S. Patent Office)
EXCLUSIVELY
PLUMB



PLUMB

DOUBLE LIFE

**Hammers Hatchets
Files Sledges Axes**



"Pick the pipe-smoking man every time"

Gilda Gray

The pick of
pipe-smokers
—because it's



Quality created
the demand—
Demand made
possible the price

**NOW
12¢**

Guaranteed by
The American Tobacco Co.
INCORPORATED

Popular Science Monthly

The Magazine of Invention and Discovery

MARCH, 1926; Vol. 108, No. 3
25 cents a Copy; \$2.50 a Year



Published in New York City at
250 Fourth Avenue

Don't Miss These Features

BEGINNING in this issue, **POPULAR SCIENCE MONTHLY** offers \$1,000 in cash prizes each month in a remarkable new Picture Contest in which John and Mary Newlywed return with fascinating problems for you to solve. This contest is open to everybody. Turn to page 11 and read how you may win one of the big cash prizes, and at the same time train your mind to keener observation.

ABOUT this time every year many of us get out our pencil and paper and renew our planning of the new home we have dreamed of. Others of us find equal pleasure in new schemes to improve and beautify our present abodes. This business of



home building is mighty fascinating, but it has its pitfalls. It also has its little "kinks" and "dodges" that save money and trouble. In "Mistakes I Made in Building My House" on page 28 you'll find one of the most interesting and helpful articles on the subject ever printed.

HUNDREDS of readers have written telling us how much they enjoyed trying the mental tests published in last month's issue. Another and equally fascinating set of tests appears

Tom Shevlin, one of the greatest all-round athletes ever produced at Yale. Death ended his career in his 30's. Do athletes die young? See page 34

in this issue on page 26. See how well your mind works. It's a profitable game that anyone can play.

THE number of great athletes whose lives have been snuffed out in recent months has aroused much questioning, especially among those of us who are lovers of sport. Is there danger in much strenuous exercise? Do the stars of football, baseball, boxing, tennis, and rowing burn out before their time? Is the "athletic heart" a hazard to guard against? A remarkable article on page 34 answers these questions.

DID you ever stop to think how many of the comforts and conveniences you enjoy today were born of poverty, heart-breaking discouragement and dogged determination? Read, on page 31, the dramatic story of a great inventor whose courage freed thousands of women from the bonds of drudgery.

And 200 Other Articles and Pictures, including—

Page	Page	Page
Popular Science Institute of Standards..... 6	New Links in the Ever-Growing Girdle of Science..... 38	A Club to Retrieve Golf Balls..... 52
How Some Men Lead Double Lives..... 9	Women Who Hold Men's Jobs..... 40	How Much Do You Know About Science?..... 52
A Fascinating New Picture Contest..... 11	Seven Ways in Which Seven Men Defy Age..... 41	Novel Plow Needs No Horse..... 52
The First American Scientist..... 14	Famous Train Installs Electric Kitchen..... 42	Plane Takes Off from Land, Ice or Water..... 53
How Test Tubes Solve Crime..... 15	Runs Motor Bus on Rails..... 42	New Rustless Diving Suit..... 53
By G. B. Seybold	A Lamp That Casts No Shadows..... 42	Know Your Car..... 53
Caging a Pierce Canyon Stream..... 17	Lifeboat Prevents Submarine Fatalities..... 43	Curious and Practical New Inventions..... 54
Folks Who Fly Their Own Airplanes..... 18	Motorized Hansom Cab Popular in Paris..... 43	Strange Sources of Music..... 55
By Edgar C. Wheeler	Kite Inspired by Flettner's Rotor Ship..... 43	Automatic Signal Robs Fog of Danger..... 56
Marvels of the Electric Home..... 20	The Most Thrilling Game in the World..... 44	They Lighten Woman's Job..... 58
Can a Bald Man Grow Hair?..... 21	Phone Meter Registers Calls..... 46	How to Be a Radio Weather Fan..... 60
By Frederic Damrau, M.D.	First Motor Driven Passenger Ship..... 46	By John Carr
A Bear Hunt 20,000 Years Ago..... 23	A Lock Washer That Really Locks..... 46	New Products of Radio Genius..... 62
The Power of Five Niagaras..... 24	New Type of Armored War Tank..... 47	How to Use Radio B Eliminators..... 63
Test the Power of Your Mind..... 26	Carry Your Chair in a Cane..... 47	By Alfred P. Lane
Mistakes I Made When I Built My House..... 28	Fountain Pen for Lettering..... 47	Novel Auto Tools and Fittings..... 65
By John R. McMahon	Ingenious Machine for Picking Corn..... 48	When Your Ignition Goes Bad..... 66
He Freed Women from Drudgery..... 31	Orchard Device Sorts Fruit Mechanically..... 48	By Martin Bunn
By Robert E. Martin	A New Fuel from Bark..... 48	Ideas You Can Use on Your Car..... 68
Mysteries That Ride the Mails..... 33	Fire Truck with Self Supporting Ladder..... 49	
Do Athletes Die Young?..... 34	She Keeps Her Golf Score on Her Bracelet..... 49	
By Arthur Grahame	How Quickly Can a Trolley Car Stop?..... 49	
How Lights Paint the Gay White Way..... 36	Masters of Curious Jobs..... 50	
By Marshall D. Beuick	Odd Things Taught in Schools..... 51	
		Home Workshop..... 71
		Better Shop Methods..... 76

POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3. Entered as second-class matter Dec. 28, 1918, at the Post Office at New York under the act of March 3, 1879; additional entry as second-class matter applied for at Chicago, Ill. Entered as second-class matter at the Post Office Department, Canada. Printed in U. S. A. Copyright 1926, by the Popular Science Publishing Co., Inc. The contents of

this magazine must not be reprinted without permission. In presenting in its editorial columns numerous stories of new products of applied science, **POPULAR SCIENCE MONTHLY** does not underwrite the business methods of the individuals or concerns producing them. The use of **POPULAR SCIENCE MONTHLY** articles, or quotations from them for stock-selling schemes is never authorized. O. B. Capen, President and Treasurer; R. C. Wilson, Vice-President; A. L. Cole, Secretary.

Unfailing radio power from the LIGHT SOCKET



with

Balkite Radio Power Units

Balkite Radio Power Units give unfailing, uniform current for both circuits from the light socket. One very popular Balkite installation, especially for heavy duty sets where reserve "A" power is required is with the Balkite Battery Charger and Balkite "B." Here the noiseless, high-rate Balkite Battery Charger is ideal. If your battery should be low, you merely turn on the charger and operate the set. Balkite "B" eliminates "B" batteries entirely and supplies plate current from the light socket.

Balkite light socket equipment

Another very popular Balkite installation is with the Balkite Trickle Charger and Balkite "B." The Balkite Trickle Charger converts your "A" battery into an automatic "A" power unit that provides "A" current from the light socket, so that both circuits operate from the lighting circuit. This installation enables you to convert your present receiver into a light socket set.

Noiseless—No bulbs—Permanent

All Balkite Radio Power Units are permanent pieces of equipment, entirely noiseless, have no bulbs, nothing to break, replace or get out of order. Their current consumption is very low. All operate from 110-120 volt AC current, with models for 50, 60 and other cycles. All are tested and listed as standard by the Underwriters' Laboratories.

[The Balkite Railway Signal Rectifier is now standard equipment on over 50 leading American and Canadian Railroads]

FANSTEEL
Balkite
Radio Power Units

MANUFACTURED BY FANSTEEL PRODUCTS COMPANY, INC., NORTH CHICAGO, ILLINOIS

SOLE LICENSEES IN THE UNITED KINGDOM: MESSRS. RADIO

ACCESSORIES LTD., 9-13 HYTHE RD., WELLESDEN, LONDON, N. W. 10

© This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.



Balkite Trickle Charger

Converts any 6-volt "A" battery of 30 ampere hours capacity or more into an automatic "A" power unit that furnishes "A" current from the light socket. With 4-volt and smaller 6-volt batteries may be used either as an intermittent charger or a trickle charger. \$10. West of Rockies, \$10.50. In Canada, \$15.



Balkite Battery Charger

The popular rapid charger for 6-volt "A" batteries. Noiseless. Can be used during operation. Special model for 25-40 cycles. \$19.50. West of Rockies, \$20. In Canada, \$27.50.



Balkite "B"

Eliminates "B" batteries and supplies plate current from the light socket. For sets of 6 tubes and less. \$35. In Canada, \$49.50.

Balkite "B" II

Supplies plate current from the light socket. Will serve any standard set. Especially adapted to sets of 6 tubes or more. \$55. In Canada, \$75.

Decide where you want to go before you start!

YOU wouldn't think of getting on a train without knowing beforehand where you wanted to go. No one in his right mind would start out on a journey with no idea of his destination.

Yet, many a man starts out on life's journey without the ghost of an idea of his goal. He takes the first job that comes along. He drifts around from one sort of work to another. He makes no attempt to find out which trade or profession he is best fitted for, and which offers him the best future.

Every man has a natural talent for one particular vocation, and that is the vocation in which he will achieve the biggest success. Your talent is shown in your "hobby"—in the thing you enjoy doing most, whether it's making speeches or selling goods, tinkering with cars or electric motors, drawing pictures or keeping accounts.

But natural talent alone is not enough. It must be developed, through training.

Instead of leaving his career to accident, the successful man plans it in advance. He prepares for promotion through technical training—either with a good home-study school, residence trade school, or set of books. He gets ready for opportunity *before* it comes. He can step into a bigger job when the chance

comes his way—and it always does come to the man who is trained to accept it.

Decide on Your Future Through "Money-Making Opportunities"

How about your future? Are you looking ahead and planning for brighter times? Or are you merely dissatisfied with your present job, without doing anything about getting a better one? Right here and now you can decide on what you want to be, and how you can attain your ambition.

"Money-Making Opportunities," the new section of POPULAR SCIENCE MONTHLY on pages 128F to 158 of this issue, is the meeting-place for men who need training and those whose business is training men. Grouped on these pages are dozens and dozens of ways to win success. We have made it easy for you to decide on your career by placing all advertisements of courses of training, technical books, etc., in this one convenient section.

It will pay you to turn to "Money-Making Opportunities" now. Read carefully each advertisement. Pick out those which appeal to you most—those in the field

you'd like to enter. Then write to those advertisers for full particulars of their training.

For an hour or so of your time, and a few two-cent stamps, you can get "inside information" about your chosen profession. You can learn what others have done in the line of work you wish to follow. You can find out what your own opportunities are. You can get facts and figures that will enable you to decide quickly and rightly—to take the road best suited to you, and follow it to real success.

This is how thousands won their way to the top. Through the pages of POPULAR SCIENCE MONTHLY, men with no experience, with little or no education, with nothing but their own ambition behind them, have risen quickly to positions of responsibility and big incomes. Their opportunity is your opportunity.

Turn now to pages 128F to 158. Study "Money-Making Opportunities," come to a decision, and then act! Your future depends upon it. Make your life's journey a success by deciding where you want to go—NOW!



\$100 in Prizes

for Readers of
"Money-Making
Opportunities."
Full Details of
This Month's
Great Prize Con-
test and Last
Month's Winners
Will Be Found
on Page 128F.

33 Pages of "Money-Making Opportunities" to Help YOU Decide on Your Future TURN TO PAGES 128F TO 158 NOW



Your hardware dealer will be glad to show you these two super-tools. Ask to look at them next time you are in.

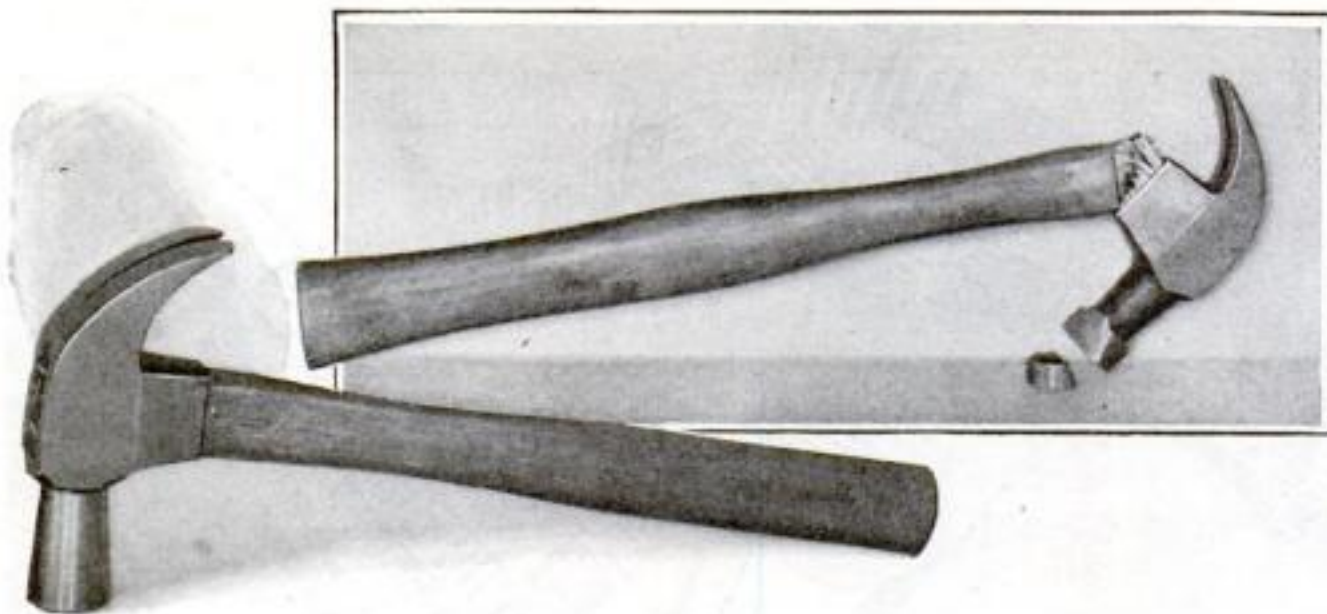
You buyers of good tools—the kind of tools that give husky, long-lived service—can't do any better than to make sure a V & B Vanadium Hammer and a V & B Unbreakable Plane are in your kit. They are made for the craftsman that buys the best. V & B Vanadium Hammers are made from Vanadium steel and handled with the finest white hickory. A Vaughan's Expansion Wedge firmly locks the handle tight. It is positive insurance of a tight head. V & B Unbreakable Planes are drop-forged—not cast. They stand the falls that would break an ordinary plane. They are furnished, too, with all Vanadium steel blades.

VAUGHAN & BUSHNELL MANUFACTURING COMPANY

Makers of Fine Tools

2114 Carroll Ave.

Chicago, Ill. U.S.A.



THESE hammers have both been subjected to the same tests by the Popular Science Institute. What happened is plainly visible. The approved hammer, below, was purchased from a reliable hardware dealer for \$1.60. The other was obtained in a chain store and cost 50 cents

Do You Know How to Select Good Tools?

By HAZEN G. TYLER, M.E., E.E.

*Associate Director
Popular Science Institute of Standards*

SHOWN two hammers—one costing 50 cents and the other \$1.60—would you be able to tell whether the difference in price was justified? Probably not, if the two hammers did not show more surface indication of their merits and demerits than the two illustrated above did when purchased.

But the tests of the Popular Science Institute of Standards proved, without question, that the \$1.10 difference in price was warranted. The \$1.60 hammer is capable of standing up under hardest usage by a carpenter for a lifetime. The 50-cent hammer is likely to break under the first hard blow.

In the first place, upon examination by a wood expert, it was found that while the handles of both hammers were of hickory, the handle of the \$1.60 hammer was of the best grade of stainless, second-growth white hickory and the 50-cent hammer handle of an inferior grade of hickory in which the grain was not true and which contained knotholes.

It will be noticed that the break in the 50-cent hammer handle is very abrupt, thus indicating the use of heart wood from the center of the tree. The best handle hickory comes from sap wood, which is tenacious and springy. Sap wood is used in the \$1.60 hammer.

A torsion machine was used in making the laboratory test on the handles. The 50-cent hammer was placed in this machine and pressure exerted. The hammer failed under 1125 pounds-inches—the fracture of the handle resulting, as is evident in the picture. But 2525 pounds-inches of pressure did only the slight damage to the \$1.60 hammer.

A second sample of the \$1.60 hammer stood more than 3000 pounds-inches of pressure before a fracture occurred.

The face and wedge test further proved the inferiority of the cheaper hammer.

Both hammers were given 10,000 blows in a striking-machine. The purpose of this test is to see if the face is affected (whether the steel is too soft or too hard) and also to determine whether the head is properly wedged. Just what happened to the two hammers, as the result of this test, is quite evident in the illustration. The face of the 50-cent hammer was broken, and the head became so loose that it might fly off at any moment. The steel in the more expensive hammer was neither too soft nor too brittle, for the face showed no effects from this strenuous test. Also, the head of the \$1.60 hammer remained unloosened.

It was noted here that the fibres in the back of the eye of the 50-cent hammer had pulled away from the head of the hammer. This shows less careful design of the interior of the eye and poor wedging. This cheaper hammer contained only two wooden wedges and no steel wedges. There were three steel wedges and one wooden wedge in the \$1.60 hammer, with the result that the handle remained firmly wedged in the head despite the exhaustive tests that were applied.

In the nail-pulling test, it was shown that the \$1.60 hammer was again superior. This test brought out such defects as wire edge and improper cleaning in the claws of the cheaper hammer. It was also evident from this test that the whole head of the 50-cent hammer had evidently been heat-treated in one operation, which meant that all parts of the head were of the same degree of hardness. In a properly-made hammer head, varying degrees of hardness in different parts are essential.

Hardness tests were conducted on the Brinell testing machine and the scleroscope, further proving the fact that the steel in the cheaper hammer was entirely too brittle.

From the results of the tests described above, and from similar results obtained from testing other hand tools, the Popular Science Institute of Standards has come to the very definite conclusion that the only way the individual buyers of tools can be sure of the quality is to buy branded and advertised tools from reliable hardware merchants.

A list of all tools (and radio products) that have satisfactorily withstood laboratory tests can be obtained from the Popular Science Institute of Standards, 250 Fourth Avenue, New York, N. Y.

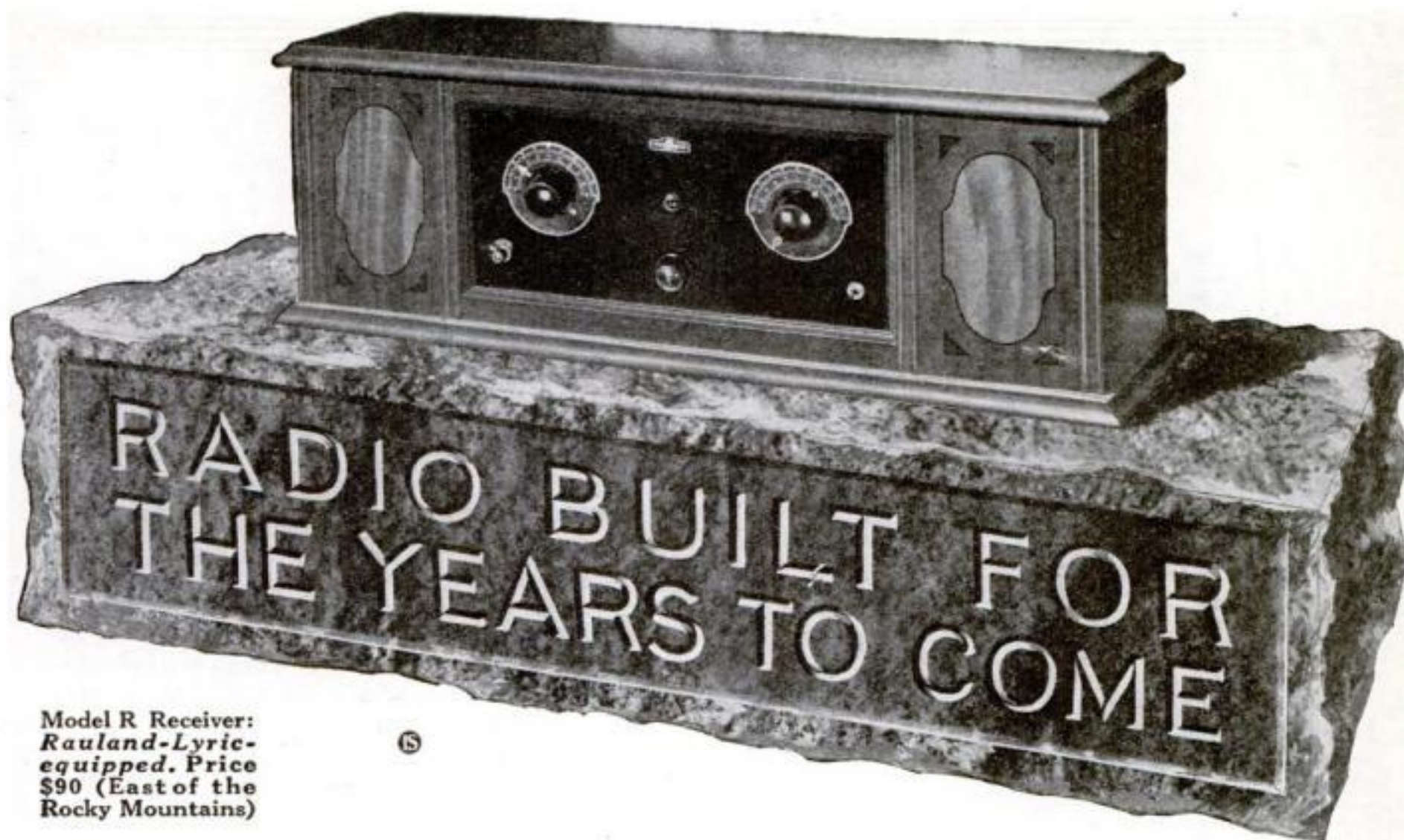
Send for List of Approved Products

POPULAR SCIENCE Monthly Guarantee

The above seal on an advertisement indicates that the products referred to have been approved after test by the Popular Science Institute of Standards.

Popular Science Monthly guarantees every article of merchandise advertised in its columns. Readers who buy products advertised in Popular Science Monthly may expect that these products will give absolute satisfaction under normal and proper use. Our readers in buying these products are guaranteed this satisfaction by Popular Science Monthly. THE PUBLISHERS.





Model R Receiver:
Rauland-Lyric-
equipped. Price
\$90 (East of the
Rocky Mountains)

Beauty and Permanence

Listeners Marvel—

at the wealth of enjoyment awaiting but a touch of the fingers.

Women Are Delighted—

with the tasteful stateliness of the Model R cabinet, as much as with the neatness of its battery accommodations.

Engineers Voice Approval—

of the rigid spot-welded steel chassis, protecting from damage every part of a set that stands as a notable example of the completely manufactured rather than the merely assembled radio receiver.

Service Men Commend—

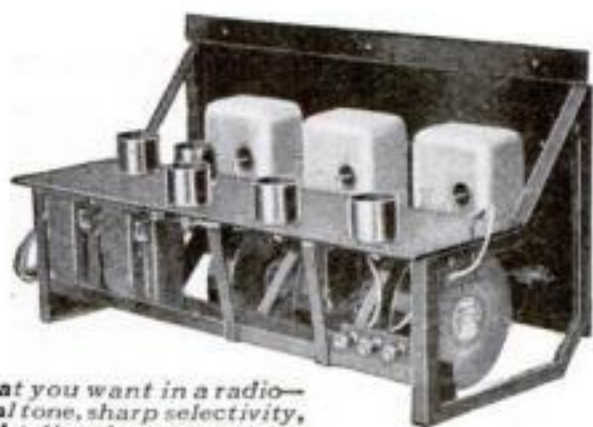
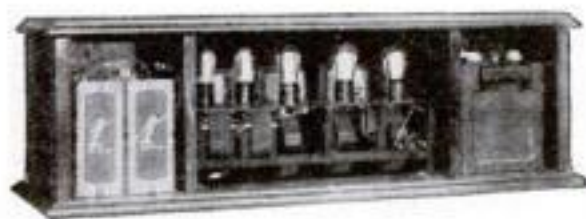
the thoroughness with which every part has been made proof against the interruption of its service, so far as human ingenuity can devise.

Dealers Are Enthusiastic—

over the excitement created everywhere by this unique receiver and the uniform satisfaction felt by its users.

Buy "Solid Value" in Your Radio

The leading wholesaler of radio apparatus in your community has probably been, for years, an ALL-AMERICAN Authorized Distributor. ALL-AMERICAN Guaranteed Radio Products are being shown everywhere by responsible and reliable dealers.



All that you want in a radio—
natural tone, sharp selectivity,
straight-line-frequency tuning
(360°) unaffected by position
of the fingers, extreme
sensitiveness, permanence.

ALL-AMERICAN RADIO CORPORATION, E. N. Rauland, Pres., 4215 Belmont Ave., Chicago, U. S. A.


ALL-AMERICAN
 Pioneers in the Radio Industry

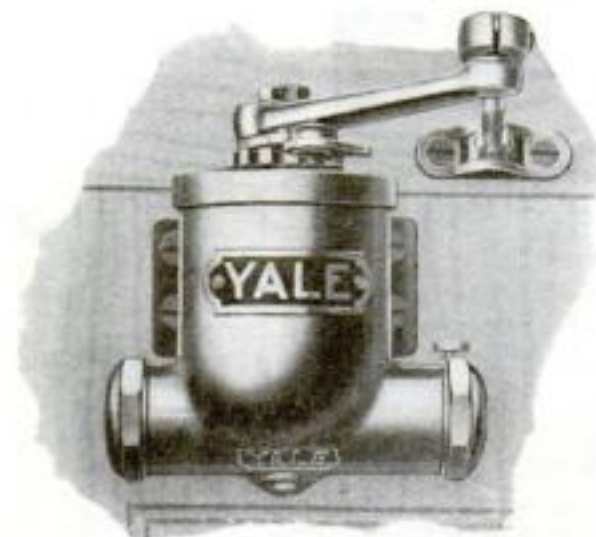
OWNING AND OPERATING STATION WENR—266 METERS



TRADE

YALE

MARK



The Yale Door Closer

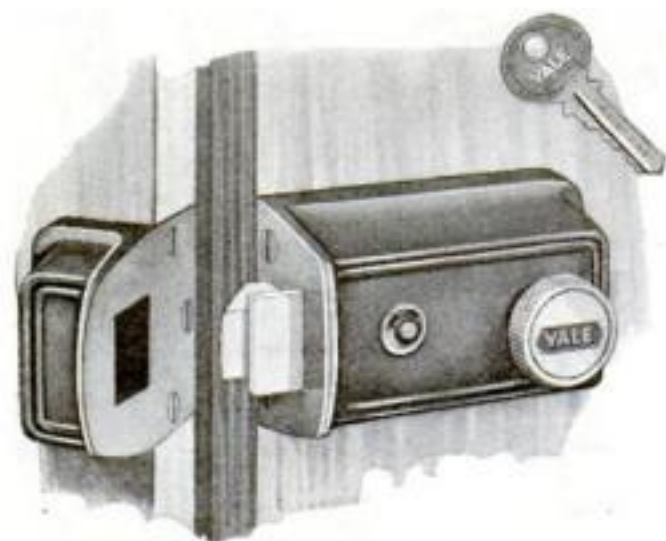
No more than the usual household tools are needed to install Yale products.

The popular Yale Door Closer, for instance, useful and convenient on many doors in every home, may be installed by simply driving a few screws.

The Yale Door Closer is a door-closing power plant: perfect in action; made with the precision of a smooth-running engine; every part co-ordinated to the quiet closing of a door.

As the door is opened the power of a highly tempered steel spring is stored up waiting for release. As the hand leaves the knob the spring unwinds, promptly starting the closing action, and at the right moment, controlled by a piston working within its cylinder against hydraulic pressure, the door gradually loses momentum and comes to a quiet stop as the latch-bolt clicks in the jamb.

This is the action of a Yale Door Closer.



Yale 44 Automatic Deadlatch

The handy man with tools will be delighted at the ease with which a Yale 44 Automatic may be attached to any entrance door.

The Yale 44 Automatic combines the functions of the ordinary spring latch with the security of the deadlock. The beveled spring-latch snaps into the strike as the door is closed and the ingenious mechanism within the lock automatically throws the springlatch forward into the jamb plate almost double the usual distance and deadlocks it there. Full directions are packed with each lock.

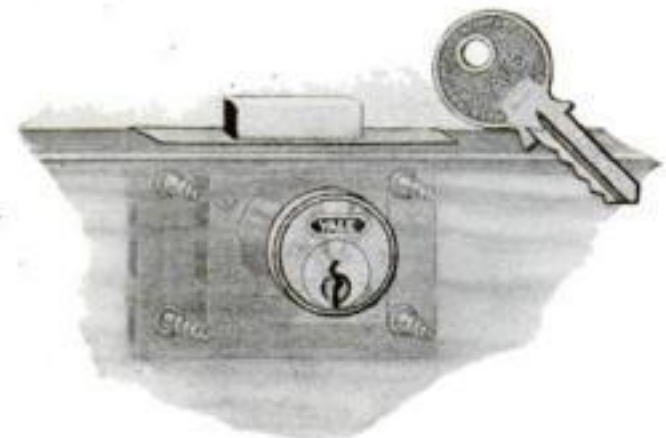


Yale No. 840 Padlock

Folks who like to see things kept in their proper places, and expect to find them there when they want them, can make good use of one or more Yale Padlocks.

There are many places about every home where Yale Padlocks should be used. The ease with which they may be put in service, their business-like appearance and the security which they afford, appeal to the man who desires real lock protection.

The Yale No. 840 is a particularly sturdy example—and there are other Yale Padlocks for every purse and purpose.



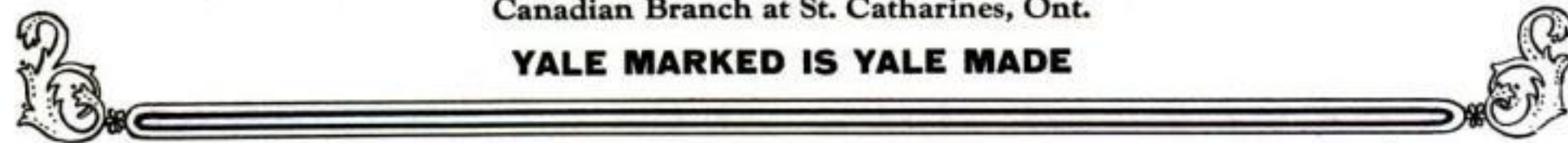
Yale No. 5551 Cabinet Lock

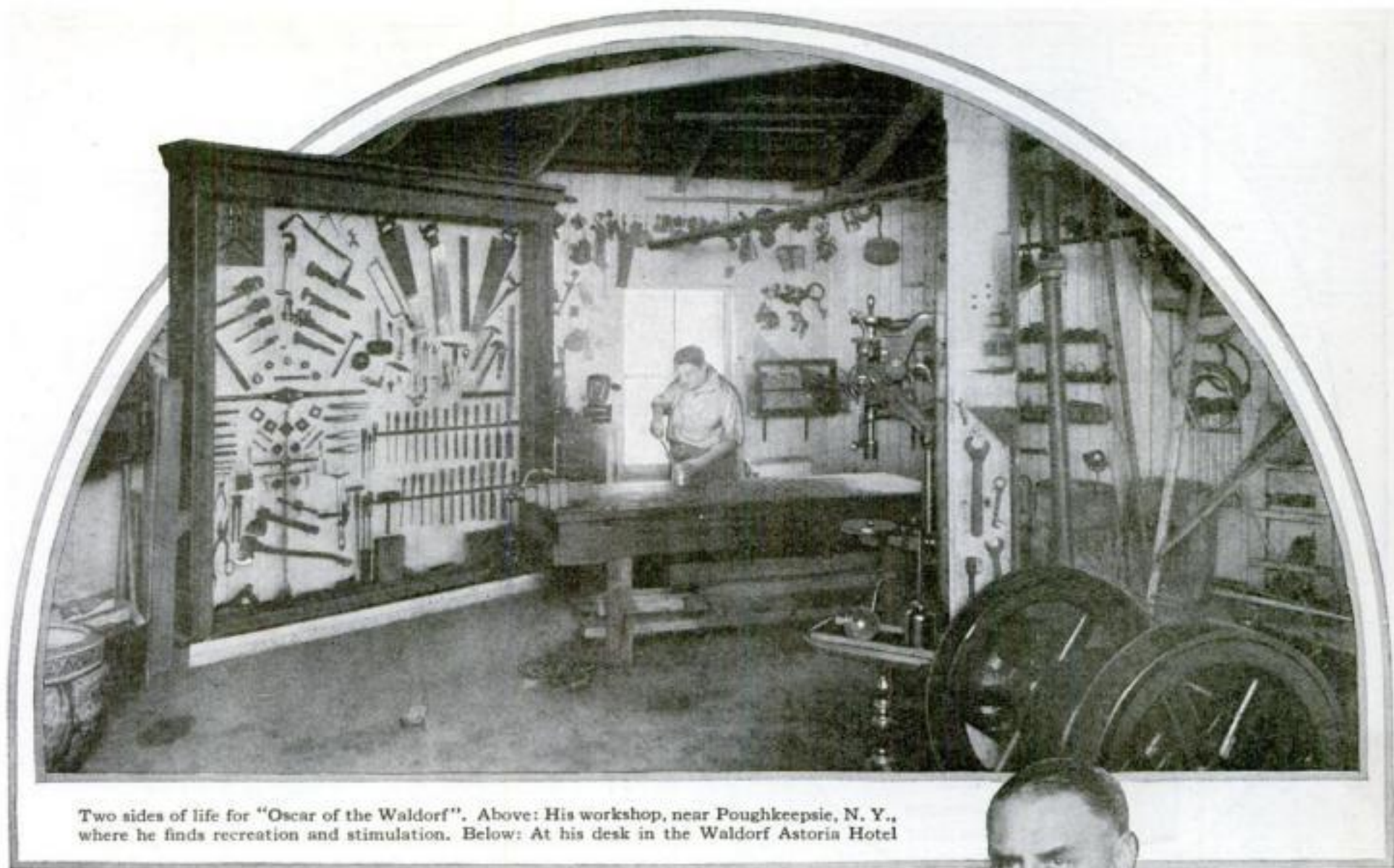
In every home there is always a special drawer or cabinet closet that should be kept "under lock and key."

A Yale Cabinet Lock No. 5551 will do the trick. This handy Yale Lock enables the user of tools to show his skill without the slightest difficulty and provide for himself a private drawer or closet easily, quickly—and secure against intrusion.

The Yale & Towne Mfg. Co., Stamford, Conn., U. S. A.
Canadian Branch at St. Catharines, Ont.

YALE MARKED IS YALE MADE





Two sides of life for "Oscar of the Waldorf". Above: His workshop, near Poughkeepsie, N. Y., where he finds recreation and stimulation. Below: At his desk in the Waldorf Astoria Hotel

How Some Men Lead Double Lives

SINCE the early nineties, New York has known Oscar Tschirky, its most popular hotel host. "Oscar of the Waldorf," immaculate, smiling, suave, is part and parcel of Fifth Avenue. Kings and potentates have decorated him. Financiers and statesmen call him their friend. Few men have been known to more of the world's celebrities.

But up in the Catskills they know another Oscar—an Oscar strange to the associates of "Oscar of the Waldorf." There he is Oscar, expert machinist; a master craftsman, proud of his tools and of his shop. Skilled with his hands, he repairs farm machinery, makes hinges and weather vanes, and has built for himself a complete automobile.

For thirty years, Oscar has spent his odd moments in his machine shop. Sheltered from the cares of his workaday world, he has found recreation and stimulation. A good tool in his hands, he says, lulls his mind into tranquillity.

Thousands of us lead such double lives behind the masks of our regular occupations. Maxfield Parrish, the painter, spends all of his spare time in his completely equipped machine shop in New Hampshire. Josef Hofmann, the pianist, William Travers Jerome, the famous attorney, and Ferdinand, King of Rumania, also

find solace and inspiration in the rhythm of revolving machinery.

Walter Prichard Eaton, the novelist, is proud of his carpentry, and Frank Hedley, head of New York's subways, of his ability as a plumber. General Pershing is a good machinist, Henry L. Doherty, the oil magnate, an expert electrician, and Walter Damrosch, conductor of the New York Symphony Orchestra, paints furniture. And the list is long, for in good tools there is a fascination for most men.

KEEP on leading your double life. Honest craftsmanship offers most of us the change from routine our minds need. Folks who spend odd moments making useful things never have to kill time as do the worthless. And remember that it is the little known Oscar of the Catskills who provides the power that makes "Oscar of the Waldorf" famous.—S. N. B.

Grebe
"Colortone"

Flexible Unit Control



The high-wave reception range of the Grebe dial (B)—from 550 down to 240 meters—equals the practical tuning range of the usual receiver. The low-wave range of the Grebe dial (A) provides additional reception down to 150 meters.



Grebe
Binocular Coils
Reg. U. S. Pat. Off.
and
Low-wave
Extension
Circuits



It is written:

"It is foolish to try to graft a bamboo shoot on a cherry tree."

The adding of Grebe developments to other receivers does not put Synchrophase quality into them. Only Grebe can do that.

Doctor H. H. H.



All Grebe apparatus is covered by patents granted and pending.

Always Well in Advance

THE Synchrophase, as usual, is fully a year in advance of other receivers. This is due to those Grebe developments which have contributed so much to the improvement of radio reception. As past experience will show, these advances may be adopted, perhaps next year, on sets of other manufacturers.

So, in buying a Synchrophase *now*, you are assured of a receiver well in advance of others, and a quality of reception which they will take some time in equalling, if ever.

*A demonstration by your dealer
will convince you.*

A. H. Grebe & Co., Inc., 109 West 57th St., N. Y.

Factory: Richmond Hill, N. Y.

Western Branch: 443 So. San Pedro St., Los Angeles, Cal.

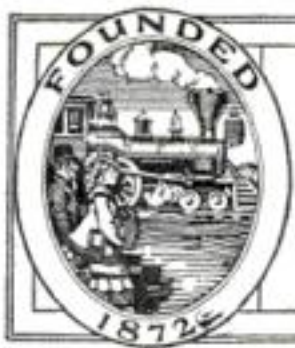
This company owns and operates stations WAHG and WBOQ; also low-wave re-broadcasting stations, mobile WGMU and marine WRMU.

THE GREBE SYNCHROPHASE

TRADE MARK REG. U. S. PAT. OFF.



The Synchrophase is also supplied with battery base.



\$1000 Cash Prizes Each Month

John and Mary Newlywed Return in **A Fascinating Picture Contest**

HERE they are again—John and Mary Newlywed—this time in a fascinating new series of Picture Contests . . . Just the kind of contests that will entertain you and the members of your family during the long evenings. . . . Just the kind to repay you materially in substantial cash prizes. . . . Just the kind that will prove helpful to you in solving the everyday problems about the home. . . . Just the kind, too, that will pay you the largest rewards in what cash cannot buy—the exercise of your mind to wider observation, keener perception, and greater ingenuity.

Beginning with this issue, POPULAR SCIENCE MONTHLY offers \$1000 in cash prizes each month to the readers who prove themselves to be the most observant. Each month we are printing a picture of John and Mary Newlywed busy at some odd job about the home. In each picture John or Mary, or both, are doing, or have done, one or more things in the wrong way. And in addition there are a number of mistakes made by the artist in drawing the picture. The cash prizes—63 in all—will be awarded to those readers who can point out the largest number of mistakes, of any kind, in the picture, and who present their explanations of the errors in the clearest and most skilful manner. Each monthly contest is complete in itself and is open to everybody, everywhere. No expert knowledge is required. You need only be alert and observant.

If you were among the thousands of readers who entered our great \$10,000 "What's Wrong" Contest last summer, you will need no introduction to John and

Mary. If, however, they chance to be strangers to you, it is sufficient to say that this young couple have just established themselves in a new home—a home that is not altogether new nor altogether old. Here they are confronted with many new problems that they meet in their own way, usually with more enthusiasm than skill. They make all sorts of mistakes and get into all sorts of difficulties, some of which you yourself have experienced.

The new contest beginning this month is a sequel to the one that recently ended in that it carries John and Mary on through their adventures in homemaking. While the best features of the former contest are being retained, new and unusual ones have been added.

In the previous contest you were asked to point out only a single mistake made by John or Mary, and a single mistake made by the artist in drawing each picture. In the new contest there are several mistakes in each picture, both John's and Mary's mistakes and the artist's mistakes. You are to see how many of these mistakes you can find, and tell us why they are wrong. Here's the way to go about it:

First turn this page and read the rules of the contest carefully. Then study the picture in this month's \$1000 contest. This you will find on the page opposite. Here you see John and Mary at work on their car. What things are they doing that they should not be doing, or what things are they doing in the wrong way? Now study each detail of the drawing carefully. Does everything look as it should look? What objects in the picture appear to have been drawn in the wrong way?

One of These Prizes May Go to You

ONE thousand dollars in cash prizes will be awarded each month to the winners in a remarkable series of contests starting in this issue. There will be a complete contest each month in which the prizes will be distributed as follows:

First Prize	\$ 500
Second Prize	100
Third Prize	50
10 Prizes, \$10 each	100
50 Prizes, \$5 each	250
Total Monthly Prizes	\$1000

How many mistakes can you find?

Get out your pencil and paper. Jot down each mistake as you find it, explaining as briefly as possible why it is wrong. When you have listed all the mistakes you can find, copy the list neatly with typewriter or pen and ink, numbering your answers in order, and send it in to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City. Remember to write on one side of the paper only, and to write your name and address plainly on each sheet of your contribution.

If, when you have completed your list, you feel that you may have overlooked some of the mistakes, you are at liberty to call on your friends or neighbors for assistance. If, too, after you have sent in your entry, you discover additional mistakes in the picture that you overlooked, you can send in another and more complete entry. In fact, you can send in as many separate entries as you wish. Additions and corrections for entries already submitted will not be accepted.

WATCH FOR NAMES of the winners of \$6000 in Grand Prizes in our great \$10,000 "What's Wrong" Contest which was completed last fall. These awards will be announced in next month's issue. Of course you'll want to know who has won the First Grand Prize of \$2500; the Second Prize of \$1000; the Third Prize of \$500, and the other 305 prizes. The complete list of Grand Prize awards will be published in our April issue, on the news-stands March 10.



All entries in this month's contest must be mailed or delivered to the Picture Contest Editor not later than March 30. This should give you ample time to study the picture and fill out your list of mistakes.

You'll find this new competition not only fascinating and entertaining as a pastime, but exceedingly helpful. In the previous "What's Wrong" Contest, hundreds of readers wrote to us telling how their study of the problems of John and Mary helped them to solve their own problems about the home.

"This contest has proved a veritable 'Thousand and One Nights' Entertainment," wrote one young couple; "and in the end it has left us both wiser and with a fuller knowledge of what to do and how to do it in our home and surroundings. Many of the solutions were found in the pages of POPULAR SCIENCE MONTHLY; others, through the knowledge that comes only with experience. All in all, we can truly say we have enjoyed to the utmost this beneficial schooling in the care and management of an institution we all should cherish—the home."

Hundreds of other readers have told us that the "What's Wrong" pictures proved helpful in stimulating

The Rules of the Contest—Read Them Carefully

1. Each month, beginning in this issue, and until further notice, POPULAR SCIENCE MONTHLY will print a picture of John and Mary Newlywed doing some simple job about the home. Each picture will show John or Mary, or both, doing one or more things in the wrong way and, in addition, there will be a number of deliberate mistakes by the artist in drawing the picture. You are to tell us what things are being done wrong and what things are drawn wrong in each picture, and why they are wrong.

2. POPULAR SCIENCE MONTHLY will award \$1000 each month in 63 cash prizes for the best answers giving the greatest number of mistakes in the picture. These cash prizes will be distributed as follows:

First Prize.....	\$500
Second Prize.....	100
Third Prize.....	50
Next 10 Prizes, \$10 each.....	100
Next 50 Prizes, \$5 each.....	250
Total Cash Prizes each month.....	\$1000

3. Prizes will be awarded to those persons who point out the largest number of actual mistakes found in the picture and who present their explanations of the errors in the clearest and most skilful manner. Actual mistakes shall be construed in all cases to mean mistakes appearing in the picture about which there can be no question in the opinion of the judges. In case of ties, the full amount of the prize will be given to each tying contestant.

4. Answers to each picture must be mailed or delivered to the offices of POPULAR SCIENCE MONTHLY not later than the thirtieth of the month following the date of publication of the magazine in which the picture appears. Thus, to insure consideration in this month's contest, answers to the picture in this month's issue, published February 10, must be mailed or de-

livered not later than March 30. No entry bearing a postmarked date later than the closing date for entry will be considered.

Another Contest Next Month

THE second \$1000 Picture Contest of this remarkable series will appear in next month's issue. Watch for it. Other similar contests will appear in succeeding issues of POPULAR SCIENCE MONTHLY. Each will be a complete contest in itself. Thus, if you should fail to win one of the cash prizes one month, you always will have as good a chance as any one to win a prize the next month.

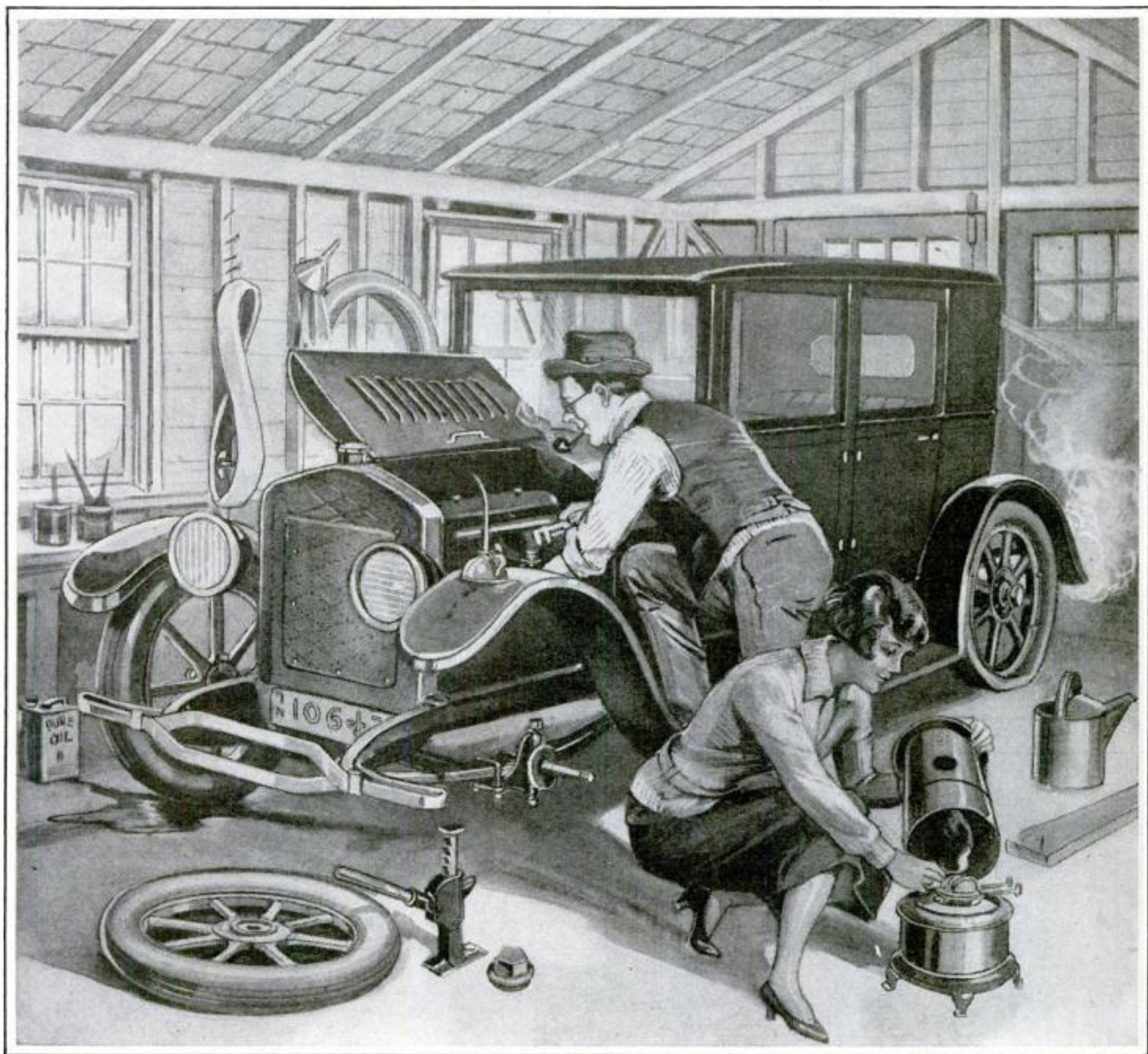
5. Answers may be submitted on any kind of paper, but they must be typewritten or written in ink, and on one side of the paper only. Each error must be listed separately and numbered. No

6. All entries should be addressed to the Picture Contest Editor, POPULAR SCIENCE MONTHLY, 250 Fourth Avenue, New York City. Name and address of the entrant must be written plainly on each page of the entry. Entries with insufficient postage will not be accepted. The publishers cannot be responsible for delay, loss, or non-delivery of entries. No contribution entered in this contest will be acknowledged and none will be returned. No letters of inquiry regarding points covered in the rules can be answered.

7. You pay nothing. Just prove your knowledge and observation. You need not buy POPULAR SCIENCE MONTHLY to compete. You can borrow a copy from a friend or you can examine one at any office of POPULAR SCIENCE MONTHLY or at public libraries free of charge. Each contest is open to everybody, except employees of POPULAR SCIENCE MONTHLY and the Popular Science Institute of Standards and their families.

8. Officials of the Popular Science Institute of Standards will act as judges and their decisions will be final. Acceptance of these rules is an implied condition of each entry.

How Many Mistakes Can You Find in This Picture?



IN THIS picture John and Mary Newlywed are seen in the garage at work on their car. They are doing, or have done, one or more things in the wrong way; and in addition the artist has made a number of mistakes in drawing the picture. How many mistakes can you find?

POPULAR SCIENCE MONTHLY will pay \$1000 in cash prizes to contestants who point out the largest number of mistakes and present their explanations of the errors in the clearest and most skilful manner. The game is fascinating and the prizes worth going after. Read the rules on page 12

their minds. In exactly the same way this new contest will help you train your mind to make a record of the things you see. It will make you more wide awake and more observant.

To compete successfully, you do not need to be a handy man nor do you need any special artistic ability. The errors in the picture are of a kind that almost anyone should be able to discover after a little study. And remember, you can always ask your friends for help if you feel you need it.

You'll find it as fascinating as a game. Perhaps you will be able to find in the picture mistakes which even the artist was not aware of when he drew it. In your enthusiasm, however, don't try to manufacture mistakes out of things that are obviously correct. You must suggest the correction for every flaw that you find.

The officials of the Popular Science Institute of Standards will be the judges in this month's contest and in each succeeding contest.

Their decisions in all cases will be final. In case a number of contestants submit the same number of mistakes, the selection of the winners will be based on clearness and skill in presentation. In case of ties, a duplicate award will be given to each tying contestant.

Are you ready to go? In the hunt for mistakes there's a lot of real fun in store for you, and, if you look sharp, a fine chance to win big rewards.

America's First Scientist

*A Mysterious Genius
Labored in Mexico
Long before Christ,
Says Noted Explorer*



A Timepiece in Stone

This ancient Mayan calendar, now deciphered, reveals a system of measuring time more accurate than any other the world has known.

MORE than 2,500 years ago, there lived on the American continent a great scientist, a genius who made startling discoveries and formulated important principles in mathematics and astronomy that antedated by centuries the first attempts of the fathers of our modern science to peer beyond the veil that shrouded them from knowledge of their world.

No one knows the name of this wonderful ancient savant. It may remain forever a mystery. His fame, though, is made everlasting by his amazing work, the purport and importance of which were discovered recently by Dr. Herbert J. Spinden, distinguished archaeologist of Harvard University.

Dr. Spinden, by deciphering the inscriptions on the ruined temples and crumbling stone houses found in Guatemala and Honduras, has proved definitely that the Mayas who built them were a highly cultured, civilized people.

That these people inhabited the western hemisphere centuries before Christopher Columbus' time has been known, of course, but it remained for Dr. Spinden to fix definitely the time at which these early Americans reached their highest state of culture, which was in the seventh century after Christ. And now he has finally succeeded in checking up the Venus calendar of the ancient Mayas with the true astronomical positions of the planet Venus in the sixth century before the Christian era!

These latest investigations prove beyond doubt that the mysterious unknown scientist developed, by abstruse mathematical calculations, and observation of astronomical phe-

nomena, a system for measuring the passage of time that is more accurate than any other method. In fact, this amazing man was the constructor of a machine for timekeeping that worked without error for almost 2,000 years! This marvelous machine was destroyed by fanatical priests during the terrible Spanish Inquisition. This act of insensate vandalism was directed by Bishop Landa, who was also responsible for the burning of all the native records of the Mayas. Afterward, he was recalled to Spain and placed on trial for his cruelties.

Dr. Spinden's recent discovery makes it possible to translate the dates on the ancient inscriptions into the Gregorian calendar we use today. All of these records show vaguely yet unmistakably the influence of the great man whom Dr.



Solved Mayan Calendar

Dr. Herbert J. Spinden of Harvard, who recently revealed the existence of a master scientist on the American continent in 613 B.C., is shown above. Dr. Spinden is now on his fifteenth expedition to Yucatan, where he is deciphering more of the strange monuments left by the long-vanished race of Mayas.



Sighting the sun from one of these markers to another, told the Mayans the time of year



Dated: 523 A.D.

Interpreted at last, the inscription on this richly carved stela at Copan, Honduras, marks Mayan culture at the height of its expression.

Spinden calls "a figure grand and mysterious as Zoroaster or Buddha at the beginning of history in Persia and India."

The Mayas at this time lived on plains where a six-month period of rain every year gave great fertility to the soil, permitting the people to raise two crops a year if their planting and reaping were properly timed. The necessity for accurate timing in planting the crops was the incentive which resulted in the marvelously precise timekeeping system.

"Hundreds of native dates found on Mayan monuments and temple walls have been translated into our calendar," says Dr. Spinden, "and evidence of their highly scientific methods and the extremely accurate results which they obtained in their calculations increases with further research. The Mayas reached practically the same figure for the true length of the year that we have today. They made calculations over vast stretches of time. Their calendar was more accurate than our own, which has an error of one day in 3,300 years."

How this great nation fell from the heights of grandeur, archaeologists do not know. Its passing is one of the tragedies of history, for while some 14,000,000 cultured people inhabited Yucatan and Central America in the days of the mysterious great scientist, less than 4,000 ignorant, impoverished Indians now are all that remain of the Mayas.

How Test Tubes Solve Crimes

The Story of a Remarkable Police Laboratory Where the Thinnest Thread Gives a Clue

By G. B. SEYBOLD

TWO MEN, good friends for years, had quarreled. One night one of them, stepping out of his home, saw a man rise from a stooping position near the front porch and disappear around the corner. Under the porch he found a bundle of oil-soaked rags. Inside it was a chunk of sulphur. A piece of oil-soaked string, with one end around the bundle, had been lighted, evidently to act as a slow fuse.

The former friend was suspected, but he offered a good alibi, and the case seemed balked. Twenty years ago it might have been.

The oil-soaked string was taken to a chemist at Police Headquarters in New York City, where recently has been installed one of the strangest laboratories in the world, a bureau of criminal science, devoted entirely to solving crimes. High-powered microscopes, X-ray apparatus, ultraviolet light machines, remarkable photographic equipment and delicate instruments to weigh, measure, and identify mere specks, are the most dangerous foes a criminal ever met. They do not lie; their evidence cannot be disputed.

Now, two bits of string that may appear alike to the human eye, are as different, under a powerful microscope, as black is from white. Jute, hemp, and cotton are all used in string and each has individual characteristics.

THE police experts showed conclusively that the fiber in the oil-soaked string was identical with that in string used in the factory where the former friend was employed. Confronted with this amazing evidence, the man confessed.

At the head of the laboratory is a captain of police and on his staff is Edward J. Kelley, an expert chemist, who for twelve years has tested the material "exhibits" in criminal cases. A number of assistant chemists and patrolmen, all trained in some special branch of this work, spend their full time at the bureau. With it is connected the laboratory of Charles E. Waite, described in the January issue of *POPULAR SCIENCE MONTHLY*. There bullets and the barrels of guns are examined to identify the pistol from which a bullet has been fired. Lieutenants all over New York City send material from the scenes of crimes to the bureau, where it is examined and later used as evidence in court.

About three years ago, in an old house on Washington Square in New York City, a robbery



A Wonderful New Microscope

Edward J. Kelley, head chemist of the new laboratory of criminal science, using the dactyloscope, a new microscope of tremendous power, which magnifies finger prints to such proportions that even the shape of the sweat pores can be studied. When a mirror is fitted above the eyepiece, the magnification can be reflected to a screen where it can be studied.



The Latest in Finger Prints

Identification of a criminal is made more certain by this new method of taking finger prints by which an X-Ray of the finger bones and joints is made on the same plate with the skin whorls. Thus a double record is made.

took place that startled the whole country on account of the daring and cruelty of the thieves. Mr. and Mrs. Alfred Shattuck were locked in a wine closet in

the cellar and left to suffocate, while the robbers escaped with jewels.

With the aid of the police, the Shattucks hunted down the ring of criminals, tracking them to Europe, and eventually the entire gang was sent to prison.

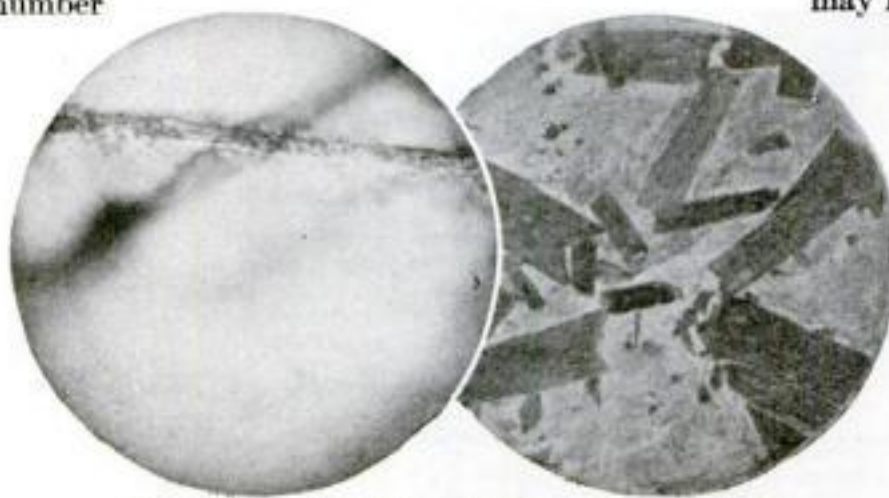
IN one of the European crime laboratories, Mr. Shattuck discovered an instrument called a dactyloscope, a microscope of tremendous power, especially designed for examination of criminal evidence. It magnifies finger prints so powerfully that even the shape of the sweat pores can be examined. The Shattucks presented a dactyloscope to the newly established crime laboratory in New York in appreciation of the work done by the police.

Finger prints are the most incriminating evidence in existence. A single print may furnish a sufficient clue.

Late one night last spring a speeding automobile in an outlying district of New York City ran into a police sergeant and killed him. His body was carried two and a half blocks on the front fender, before it dropped to the pavement.

The car was found abandoned a few blocks from the crime. The owner admitted that it belonged to him, but declared that it had been stolen from in front of his home. Apparently there was nothing to connect him with the dastardly deed.

In the impact with the policeman, however, the windshield had been smashed, and bits



Clues in Tiny Bits of Thread and Wood

Left: A single minute strand of cotton fiber (highly magnified) from the coat of a man, which proved he had taken part in a mill riot. Right: Magnified bits of sawdust and wood fiber which established the identity of a murderer, after other clues had failed.

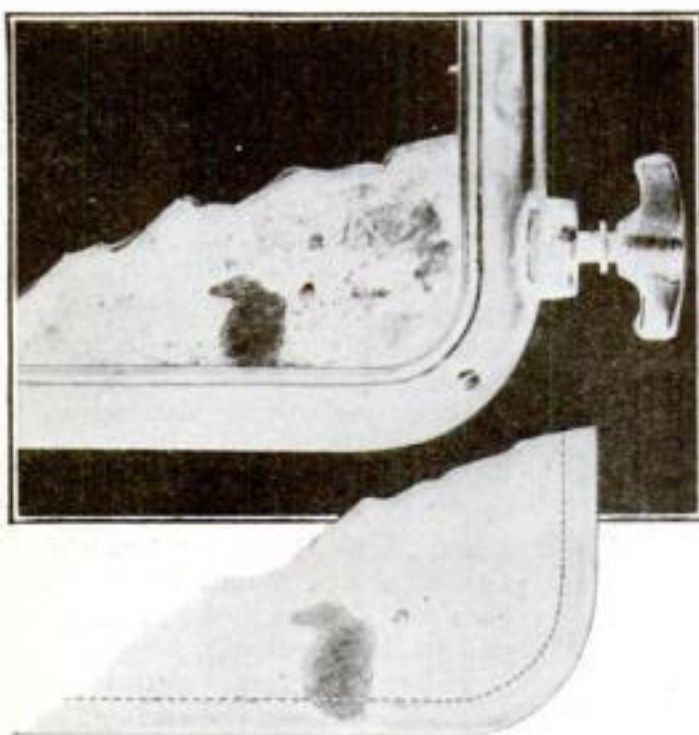
of glass scattered about. On one of these a single finger print was found.

Under the dactyloscope, this finger print was found to be that of the owner of the car. Undaunted, the owner exclaimed: "What's that? A man gets his finger print on the windshield of his own automobile! Of course it's my print."

UNCONVINCED by the man's poise, a detective fitted the broken glass into the frame of the windshield. The finger print was seen to extend beyond the bevel of the glass, to the edge covered by the frame. The print could only have been left there after the broken glass had been pulled out of the frame. This was such conclusive evidence that the owner had been with the car after the accident, that the man dropped his bluff and pleaded guilty.

With nothing but a single thread to guide him, an expert detective has been known to point to the guilty man. Some time ago a strike was in progress at a garment factory. On several successive nights some one succeeded in getting into the building and caused great damage by throwing acid on bolts of silk. Eventually the police caught a former workman in the factory, but released him when he gave a satisfactory reason for his presence.

An observant officer, however, had noticed a small hole in one of the workman's trouser legs. He made a careful survey where the destroyed silk had been piled. On a nail he found three tiny wool fibers. A laboratory examination showed they were identical with the material in the workman's trousers. Thus three



A Telltale Finger Print

This finger print, on a piece of broken windshield, brought confession from a man whose car ran over and killed a police sergeant. In the impact, the glass had been smashed. The guilty man protested there was nothing significant in his own finger print on his own car. Then a detective fitted the piece of glass into the windshield frame. The print was seen to extend to an edge of the glass wholly covered by the frame before the glass was broken

Analyzing Poison in a Murder Mystery



A view in the chemical laboratory of the new criminal science laboratory in New York City. At the left in the picture is Edward J. Kelley, head chemist; and at the right, Captain John A. Golden, first chief of the bureau

threads helped send that workman for a long visit to the penitentiary.

DUST too fine to be observed with the human eye can provide a solution for crime. In one instance the coat of a murder suspect was beaten in a dust-proof bag and cleaned with a vacuum cleaner. Examination of the powdery dust showed that it had come from the floor of the factory where the victim was killed.

Detective methods of yesterday are obsolete today. Poking about, fingering this and that, detectives frequently ruined important evidence.

Today a group of detectives goes out on every murder case. Before anything is disturbed, a photographer, using a camera with a special lens that takes in every detail of the room, photographs the scene of the crime. Thus at any time afterward the exact details of the scene can be studied for clues.

In addition to the photographs, the detectives plan to have sketches made. These will be drawn with a number of angular measurements, using a scale based on the metric system. They will record the position of the body and its relation to other objects in the room.

A photo-micrographic camera photographing the infinitesimal, is used to identify internal structure, such as crystals in drugs. For things so small that waves of ordinary

When Teeth Left Their Marks

From a half eaten cake abandoned by a gangster who had broken into a baker's shop, detectives made the cast shown below, which revealed the peculiar markings of the culprit's teeth. Within 48 hours he was arrested and his conviction followed



light are too long to record them on a photographic plate, a camera using ultra-violet light will be used.

Plaster casts and wax impressions are taken of foot prints and automobile tracks, so that these may be kept as permanent records.

AMONG the many instruments used by the chemists of the bureau is a Duboseq colorimeter, employed for examining blood. This instrument not only shows whether there is any blood in a stain, but also the exact quantity, without injuring the article examined. A speck of blood is sufficient for examination in the colorimeter. Even minute specks of blood hardened under a fingernail may be enough to accuse a man of murder.

Chemical examination is playing an increasingly important part in modern methods of detection. A thief who not long ago terrified residents in a suburban section of New York worked on a system. He would rob a row of houses in one block one night, go off to another section the next night, and on the third return to work in the first district where he had left off. Everywhere he went he dropped old-fashioned sulphur matches which strike noiselessly.

A close watch was put on the neighborhood where he was next scheduled to appear. A suspect was seized and questioned. Although he protested his innocence, in his pockets were found sulphur matches which analysis showed were of the same kind left in the trail of the robberies. A bunch of pawn tickets confirmed the evidence that brought conviction.

Hundreds of suspected poisons are examined in the laboratory. Mr. Kelley, chief chemist, tells this story:

"Some years ago a Brooklyn fruit dealer

(Continued on page 147)



Proof of a "Raised" Check

This greatly enlarged photograph revealed clearly how the figure 7 had been converted into a 9 on a bank check. You can see the joints where an additional line was added in order to enhance the value of the original figure

Spectre Chasm Dam

Right: Daring government explorers surveying site of Spectre Chasm Dam, indicated by dotted lines. This dam would be 223 feet high, developing 235,000 continuous horsepower

The Surveyors

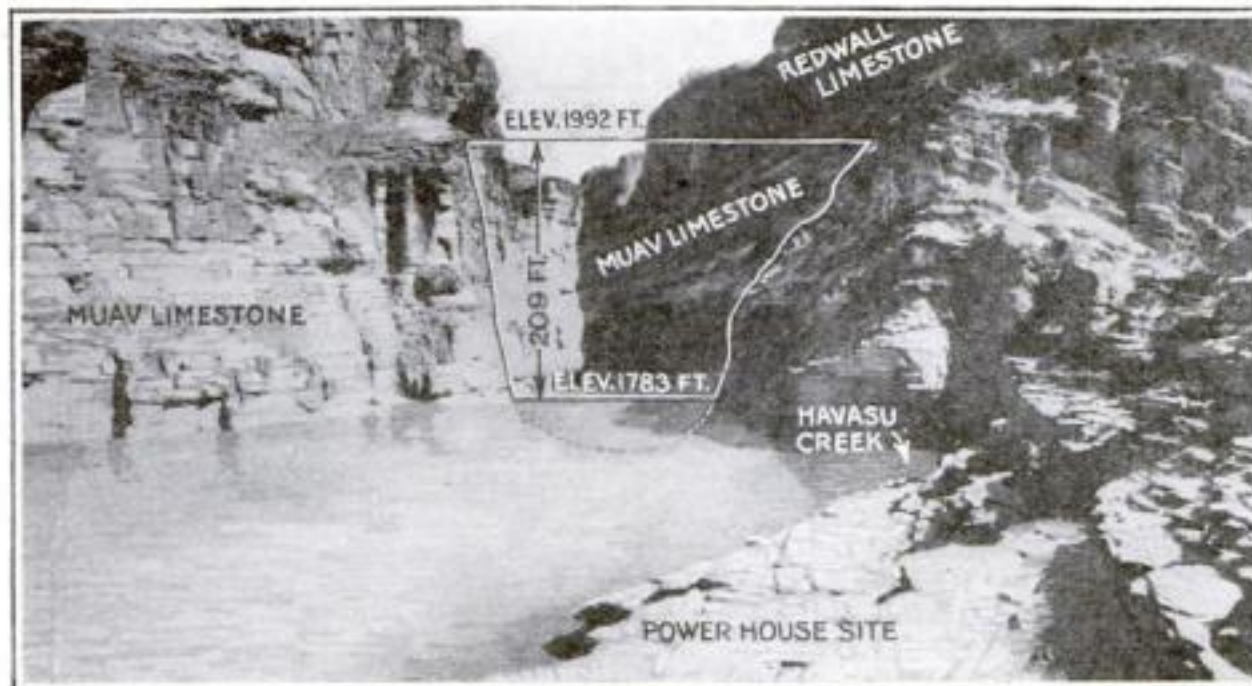
Below: U. S. Geological Survey men repairing their specially constructed boat, at the foot of Badger Creek Rapids. Only three times in history has the giant gorge been navigated successfully



Caging a Fierce Canyon Stream

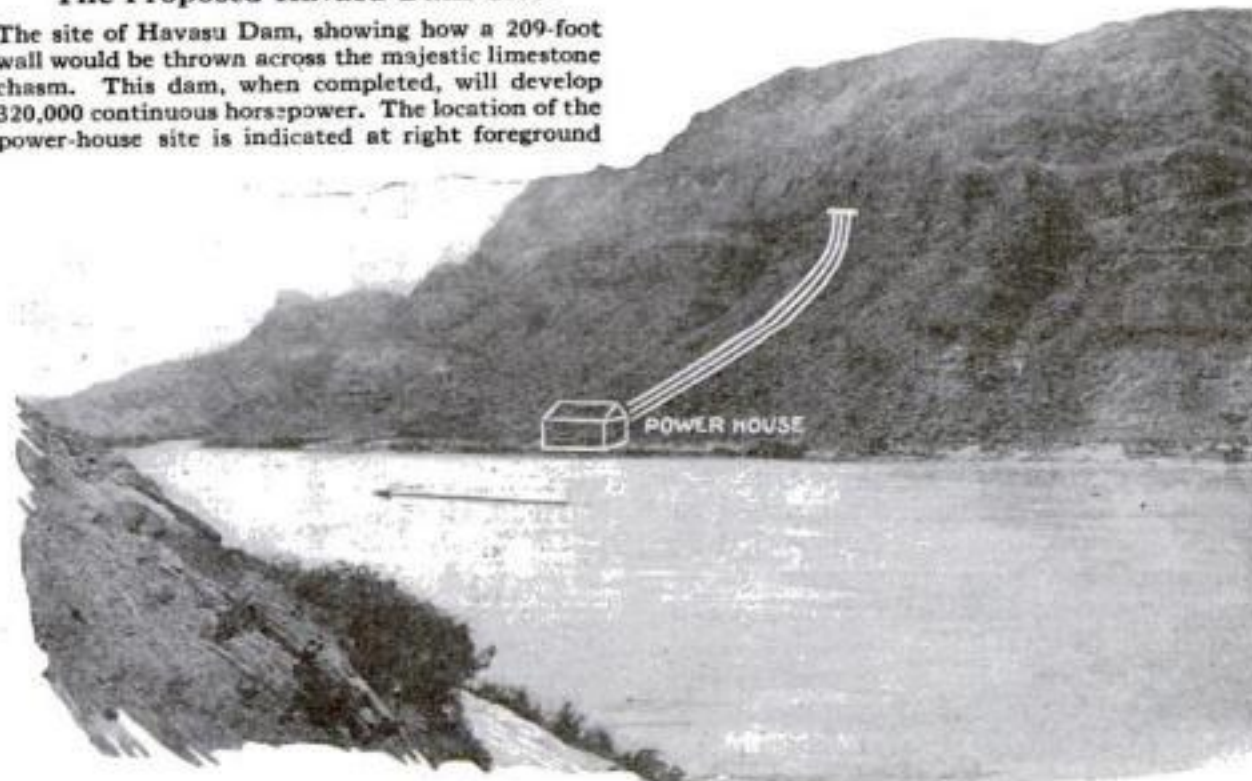
AFTER 20 years of hazardous exploration and map making, government engineers recently announced details for the huge government project to tame the seething Colorado River and transform the Grand Canyon of Arizona into a scenic storage basin for power and irrigation.

The plan calls for a series of 13 dams that will enable the region to take more than 5,000,000 electric horsepower from the river, and at the same time use the waters for irrigating 6,000,000 acres of desert land. The 13 dams would create 2000 square miles of lakes, accessible to tourists. The scenic wonders of the Grand Canyon would be left unharmed.



The Proposed Havasu Dam Site

The site of Havasu Dam, showing how a 209-foot wall would be thrown across the majestic limestone chasm. This dam, when completed, will develop 320,000 continuous horsepower. The location of the power-house site is indicated at right foreground



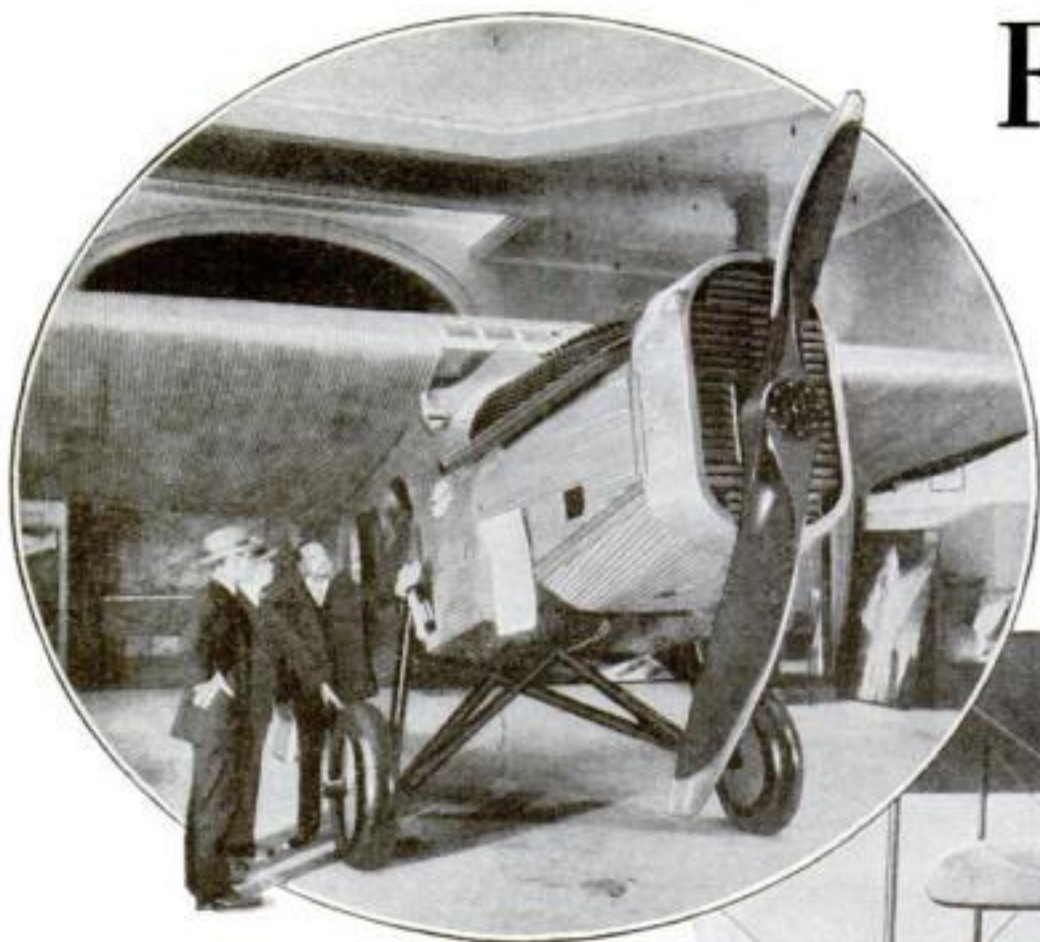
This picture gives you a good view of the Colorado River below the site of the Glen Canyon Dam. Observe the clearly indicated location of a proposed spillway and powerhouse site



Government explorers surveying a side canyon of Grand Canyon during their recent perilous trip in which they selected dam and power sites to supply the West with more horsepower

Folks Who Fly

*Doctors, Salesmen, Sportsmen
Now Travel the Sky Roads—A
Remarkable New Flying Auto*



An Item of Merchandise

The airplane has advanced so far into the practical utility class that a New York department store now displays this all-metal monoplane as one item in its regular stock. A salesman of the store is seen in the picture above showing the machine to prospective customers.

BY EDGAR C. WHEELER

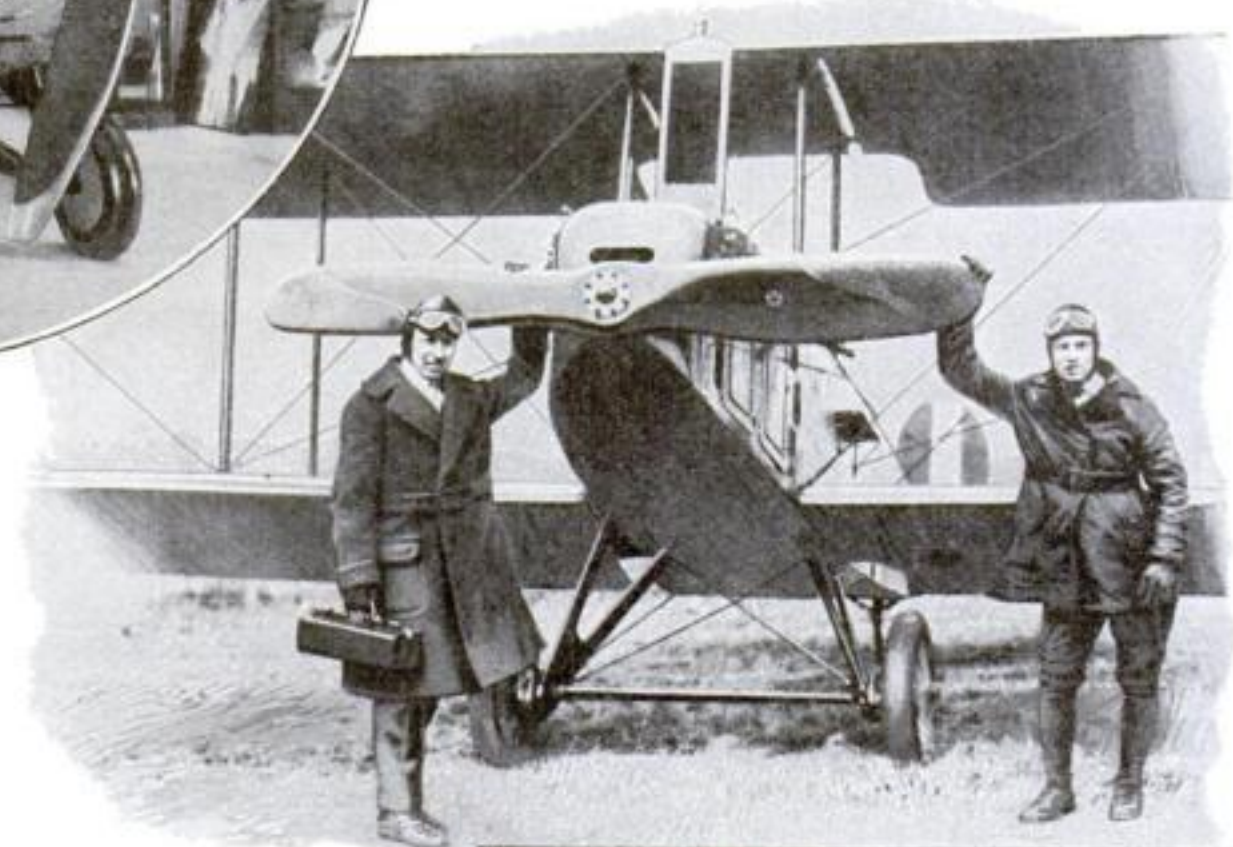
FROM Germany recently came word of a spectacular and amazing development in the field of aeronautics—a flivver plane that is at the same time an automobile; a machine only 18 feet long and less than six feet wide when the wings are folded back, small enough to be housed in the ordinary one-car garage!

This unusual automobile-airplane, the invention of J. H. Maykemper, a civil engineer of Frankfurt, Germany, is pictured in accompanying illustrations and on the cover of this issue. Throwing one lever on this machine transfers the power from the road wheels to the air propeller so that if you were traveling by road and you desired to take to the air, the wings could be snapped out into place and a short run of 100 yards or so would see you scooting skyward. Although the engine is only 20 horsepower, the inventor claims that it will carry a pilot, a passenger, and enough gasoline for a five-hour flight.

Another promising air flivver was recently designed by A. K. Peterson, pilot and chief photographer at the Naval Air Station, Anacostia, D. C., who declares his 40 horsepower machine will hop off from any back yard 100 feet long, fly 100 miles an hour, and travel nearly 25 miles on a gallon of gas.

BUT who would buy such airplanes today? What are they being used for? Do these and similar developments mean that the flying machine, after 22 years of experiment, is coming into its own at last, to take its place beside the automobile as a commonplace conveyance which any man of ordinary circumstances can own and operate?

Such queries as these have come in increasing numbers of late from readers of POPULAR SCIENCE MONTHLY. And be-



The Doctor's Car

Dr. Herman J. Neubauer of Hinkley, Ill. (left), standing with his pilot at the propeller of his two-seater biplane, which saves him precious time in making rural calls.

cause they are questions which concern all of us, the editor asked me to see if I could find the answers for the aforesaid queries.

Airplanes are being sold for personal use. Aside from those sportsmen who follow the game for the thrill of it, others are taking it up because the airplane is a wonderful time-saver. One hundred miles can be covered in an airplane in less than an hour. On good roads it would take about four hours to cover the same distance by auto, and even a railroad express train would, without doubt, use up two-and-one-half hours for the same trip.

In fact, the airplane has advanced so far into the practical utility class that at least one New York City department store now carries an all-metal monoplane as one item in its regular stock.

By an odd coincidence, it was on the anniversary day of the Wright brothers' first successful flight that I was in the office of Richard F. Hoyt, a leading Wall street broker, and heard him talking over the telephone. His side of the



Courtesy "Aviation"

Enter—the Flying Salesman

In the Oklahoma oil regions, where distances are great and train service poor, W. C. Brown, a district sales manager at Tulsa, follows the sky road when he calls on his "prospects." His biplane saves him many hours and is good advertising.

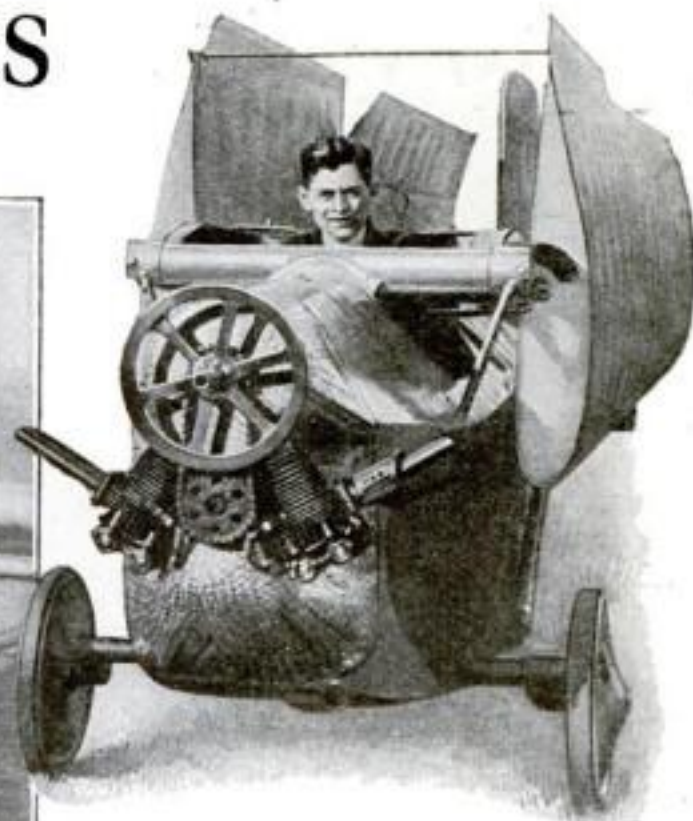
conversation ran something like this:

"Hello, George . . . Hear you're going to Palm Beach this week . . . Say, when you stop in Jacksonville, would you mind looking around to see if you can find me a good flying boat . . . Yes, a good one; no junk . . . I want to fly it down to Miami . . . You see, I'm planning a trip to Birmingham in a couple of weeks to look over some property . . . Thought I'd run over to Jacksonville and fly down the coast . . . Trains from Jacksonville

Their Own Airplanes

Auto and Plane Combined

At the right are two views of the remarkable new combination flivver plane and automobile, with its inventor, J. H. Maykemper, of Frankfurt, Germany. One picture shows the machine as an airplane, with propeller in place and wings unfolded. The other shows how the wings are folded when the machine is used as an automobile



An Aerial Sportsman

James Otis, wealthy importer and sportsman of San Francisco, starting on a hunting trip into northern California in one of his planes. He is seated behind his pilot and mechanic

always do. For traveling in comfort and saving

time on a pleasure trip, give me my airplane every time. I am a thorough believer in the airplane. It beats a train, a motor car, a motor boat, or any other means of travel you can think of."

Well, here was one answer—an enthusiastic one—to the question of who buys private airplanes, and why. Like Vincent Astor, Harold Vanderbilt, and other young men of considerable means, Mr. Hoyt has found it convenient—and a lot of fun—to commute in a flying boat from his office to his home in the country. Every summer for four years he has made week-end trips in the air to his home in Marion, Mass., on Buzzards Bay, or to Cape Cod.

"But isn't it a bit hazardous?" I suggested.

"Don't you believe it," he shot back. "There's altogether too much said about accidents and crashes. It's no trick to drive a plane. The way they're building machines now, flying is no harder than driving a car; about the only difference is that you drive in three dimensions instead of two."

"OF COURSE, I have had minor troubles, just as you would have with your car. Two or three times I've been forced down. Once my propeller burst; another time there was a leak in the gas tank. But it really wasn't very much trouble. All I had to do was to glide down to the water and sit there and wait until

a boat came along to tow me to shore. As for expense, the cost of running a good airplane nowadays is only a trifle more than that of running a good automobile.

"AND this year," Hoyt told me, in the casual way that he might have discussed the purchase of a new coupé or sedan, "I am planning to buy one of the new Wright Bellanca biplanes—a 200 horsepower machine that carries six passengers in an all-inclosed cabin. It will fly 130 miles an hour and eight miles to the gallon of gas. I intend to attach pontoons and make a flying boat out of it."

Numbers of other men and women today are buying aerial motor cars and flying them for business or for pleasure. There is the salesman who swoops down from the sky to call on a prospective customer; the doctor who rushes through the air to a stricken patient; the business executive who travels as the crow flies from office to factory or from the city to his home in the country; the sportsman who takes to wings for his fishing and hunting trips.

IN THE Oklahoma oil region, for example, there is W. C. Brown, the Tulsa district sales manager for a Massachusetts manufacturer of recording instruments. Almost any day he may be seen in his plane dodging oil derricks, or scooting down between rows of tanks at a refinery. Trips which once required two days or more on the road now are reduced to short hops of a few hours. Even if a prospect is some 300 miles from Tulsa, this former Air Service pilot can climb into his biplane in the morning and hop off with the assurance that he will be back home again before evening. Never has he had a serious mishap. He buys his airplanes as other men would buy automobiles. When one machine wears out, he buys a new one. Thus far he has used four planes in his business.

Or there is Milton P. Miller, known as "The Flying Peddler," who sells toy airplanes and travels by air through the states of Illinois and Ohio.

There are indications, too, that large business houses are preparing to put salesmen and representatives into the air.

(Continued on page 141)



Hunts Big Game by Airplane

Mrs. Madge Jauregui, famous woman hunter, of Tampico, Mexico, whose flying machine carries her into the remotest as well as most inaccessible mountain regions in search of big game

down are all tied up, I hear; some 10 hours late . . . Figure I can save at least a day by air if I can get hold of a good boat . . . Remember, though, I can't use any junk . . . Thanks, old man . . .

To many of us, even after 22 years of flying, the airplane still remains a thing more or less mysterious, a machine to be handled only by daring bird-men. But to this rather young, athletic-looking New York business man a swift journey by air apparently was an old story, almost as commonplace as a motor trip.

"You mean to fly that plane yourself?" I asked him.

"Why, of course," he replied, "I

Marvels of the Electric Home

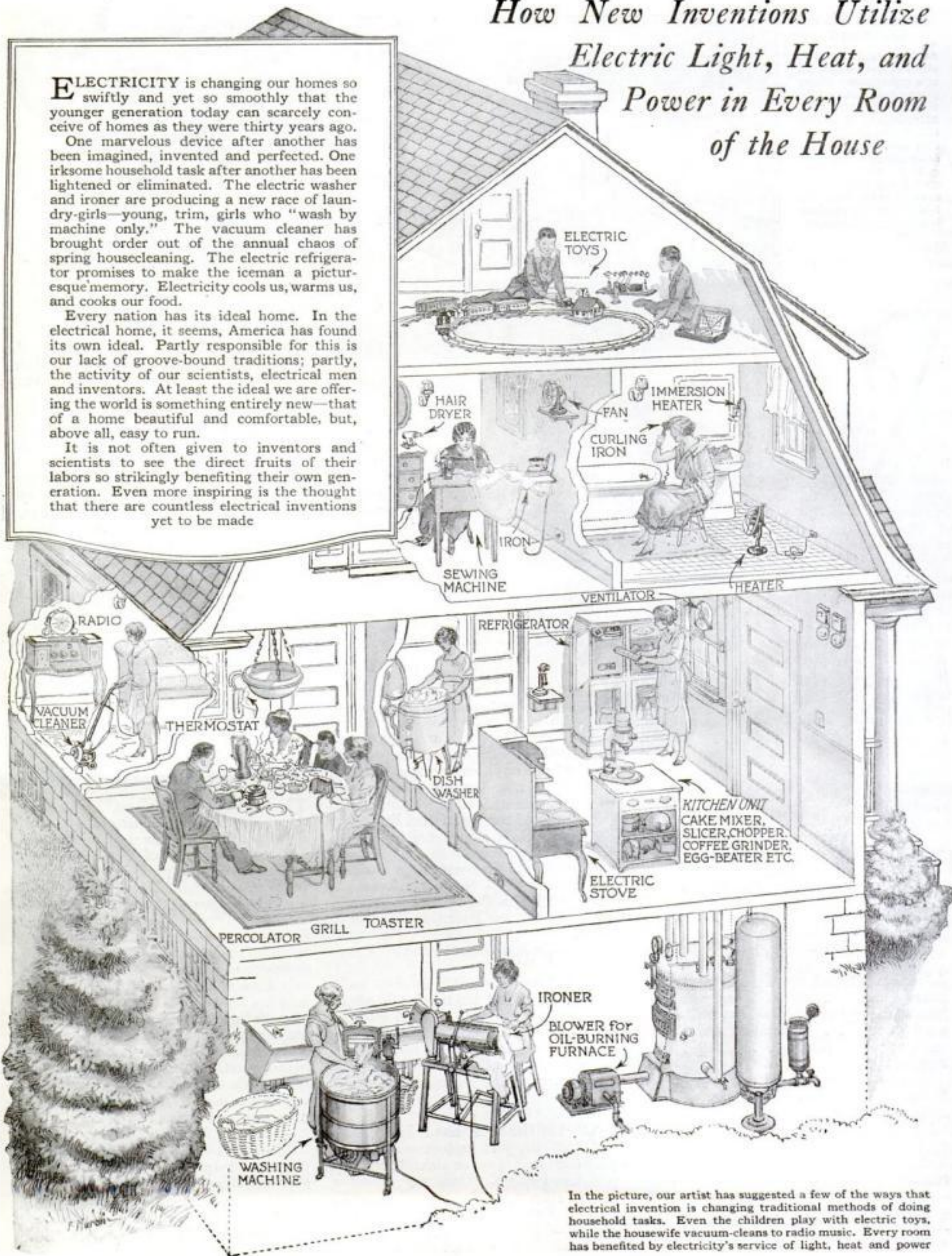
*How New Inventions Utilize
Electric Light, Heat, and
Power in Every Room
of the House*

ELECTRICITY is changing our homes so swiftly and yet so smoothly that the younger generation today can scarcely conceive of homes as they were thirty years ago.

One marvelous device after another has been imagined, invented and perfected. One irksome household task after another has been lightened or eliminated. The electric washer and ironer are producing a new race of laundry-girls—young, trim, girls who "wash by machine only." The vacuum cleaner has brought order out of the annual chaos of spring housecleaning. The electric refrigerator promises to make the iceman a picturesque memory. Electricity cools us, warms us, and cooks our food.

Every nation has its ideal home. In the electrical home, it seems, America has found its own ideal. Partly responsible for this is our lack of groove-bound traditions; partly, the activity of our scientists, electrical men and inventors. At least the ideal we are offering the world is something entirely new—that of a home beautiful and comfortable, but, above all, easy to run.

It is not often given to inventors and scientists to see the direct fruits of their labors so strikingly benefiting their own generation. Even more inspiring is the thought that there are countless electrical inventions yet to be made



In the picture, our artist has suggested a few of the ways that electrical invention is changing traditional methods of doing household tasks. Even the children play with electric toys, while the housewife vacuum-cleans to radio music. Every room has benefited by electricity's service of light, heat and power

Can a Bald Man Grow Hair?

*Don't Believe Everything
the Barber Tells You—New
Theories about Thin Locks*

By

FREDERIC DAMRAU, M.D.

A CHOICE niche in the Hall of Fame is held reserved for the scientist who will show us how to grow hair on a bald man's head. It will probably have to be held in reserve for a great many years to come.

Medical men are apt to become pretty cocky when they contemplate the unquestioned triumphs of their science. Such successful forms of treatment as the administration of quinine in malaria, of iodine in goiter, and of insulin in diabetes, are achievements of which they may well be proud. But it is a source of great mortification to physicians that, while they can often bring a failing heart up to par or deftly pluck a pus-filled appendix out of the abdomen, they are flatly helpless in the presence of the shiny hairless dome. The bald head is the medical battle-field on which the doctor must inevitably meet his Waterloo.

The medical man does not know a great deal about baldness, it is true; but he knows a great deal more than the public. What the average person knows about baldness and its causes and proper treatment, if any, would make a comprehensive encyclopedia of misinformation; hence the present article.

In medical parlance, baldness is known as *alopecia*; but whether the condition is called by its Greek or English name, the hair falls out just the same. Various types have been described and given formidable names by skin specialists. The hair loss may occur in patches; it may be the temporary result of some systemic disease which lowers the general vitality, such as typhoid fever or tuberculosis; or, in rare cases, it may be present at birth.

THE usual form of baldness, and the one in which we are chiefly interested, goes under the high-sounding designation of *idiopathic premature alopecia*. The word "idiopathic" has quite a dignified definition in the medical dictionary, but the truth of the matter is that it means nothing more than "cause unknown."

Some degree of baldness is by no means uncommon before the age of thirty, and it may be observed under twenty-five. Two brothers who once lived around the corner from me were as bald as the proverbial billiard ball before they were nineteen.

There is no question that bald heads, just like brown eyes, red hair, and many other tendencies, are prone to run in families. One might say



Hope Springs Eternal

"When hair is promised to a bald man, he buys first and thinks last, if ever. The stork supplies a new bald-headed sucker every five minutes."

that the baldness of the father is visited upon the children for generations to come. A good way to prevent baldness is to select a father with a strong crop of hair.

When baldness comes on in later years of life, the condition is accepted philosophically as one of the normal attributes of age; but when a young or a middle-aged man sees his hair-line receding, he grippily prepares to fight the loss of his hair to the last ounce of hair restorer.

The first bald spot picks its location with the accuracy of a sharpshooter. It makes its debut just back of the top of the head; in the exact terms of a mariner, we might say at 60° north latitude and right through the prime meridian of longitude. Soon afterward, the hair-line

on the forehead begins to recede. These two initial bald areas gradually extend until, in extreme cases, nothing is left but a narrow fringe of hair at the sides and back of the scalp.

Baldness does not ordinarily result from the sudden falling out of a large quantity of normal-sized hairs. The process is more gradual. As fast as the hair falls out it grows in again; but each successive crop of hair is of finer texture, until finally the hair ceases to grow altogether. "Going, going, gone," does not express the true state of affairs. To be strictly accurate, the password for admission to the Alopecia Club should be, "Going and coming, going faster and coming slower, going but not coming, gone."

EACH individual hair arises from a narrow pit in the scalp known as a hair follicle. The follicle nourishes the hair; from it the hair grows in length by a gradual multiplication of the cells at the base of the pit. As every flapper who has her eyebrows tweezed knows, the hair will grow in again so long as the follicle remains intact. If the hair follicle is destroyed, as is done for the permanent removal of superfluous hair, the hair will not grow in again.

Sometimes, during severe illnesses, there is a wholesale shedding of the hair. This type of alopecia seldom gives rise to permanent baldness, for the hair follicles are not destroyed and an early growth of new hair may be expected. But once the hair follicles have really wasted away, as occurs in the common type of baldness in men, the prospect of growing hair again is about as hopeful as that of growing grass on a glass-topped desk.

The medical grab-bag is full of discarded theories about the cause of baldness. Any writer who is satisfied with quoting an "eminent authority" as sufficient reason to sponsor any theory in particular can put his hand in the bag and draw out a perfectly plausible theory.

Exploded Theories of Baldness

THE medical grab-bag is full of discarded theories about the cause of baldness," says Doctor Damrau. Some of the most common of the exploded theories he lists as follows:

That the derby hat presses on the arteries that nourish the scalp, cutting off circulation.

That lack of air circulation under the hat plays some mysterious part in undermining the nutrition of the scalp.

That much brainwork pushes the hair out.

That dandruff makes the hair fall out by attacking and destroying the base by which the hair is nourished.

That ultraviolet light from the sun will cure baldness.

THE "derby hat theory" of baldness had considerable vogue for many years. The conception was that the hat presses upon the arteries that nourish the scalp and thus gives rise to an undernourished state of the hair follicles; furthermore, the lack of free circulation of air under the hat was supposed to play some mysterious part in undermining the nutrition of the scalp. The answer to this explanation is that, long before the derby

hat swam into our ken, the smooth, shiny dome was still quite the thing.

Another theory, which was possibly fostered by the egotism of some bald-headed men, held that alopecia is an affliction of the intellectual classes and that it results from excessive brainwork. This view is exceedingly grateful and consoling. The only trouble is that it has no basis in fact.

Dr. William Allen Pusey of Chicago, an American skin specialist of high repute, and a former president of the American Medical Association, holds that the fashion of going without hats, especially during the summer months, may be an exciting factor in causing baldness. He believes that the ultraviolet rays of the sun may, to some extent, unfavorably influence the nutrition of the hair follicles.

I HAVE a friend who, having been informed that ultraviolet light will cure baldness, reasoned that the summer sun is rich in these particular rays and should therefore check the loss of his hair. So he hired a bathhouse at the seashore for the summer and left all his straw hats home. But the only success he had was to get rid of what little hair remained.

Misanthropes say that only one person in ten has brains under his hat; the other nine have dandruff. In view of the fact that dandruff is so very common, it was inevitable that it should acquire the blame for baldness. Even in the latest textbooks on diseases of the skin, dandruff is still given as the most important cause of alopecia. Yet there are certain



Some Commonly Accepted Styles

"The first bald spot picks its location with the accuracy of a sharpshooter. It makes its debut just back of the top of the head. Soon afterward the hair line on the forehead begins to recede until, in extreme cases, nothing is left but a fringe of hair at the sides and back of the scalp."

undeniable facts, as will be shown presently, that greatly weaken the case against dandruff.

Some explanation as to the nature of dandruff is required. All dandruff is not alike. The fine white branny flakes simply represent skin scurf; they come from the outer horny layers of the skin, being composed essentially of horny cells

that have dried and separated from the parent substance. Another type of dandruff consists of rather large greasy scales, which, when closely examined, will be seen to have little holes for the passage of the hairs. This kind of dandruff is really dried skin oil (sebum) and is associated with an over-secretion of this substance.

The dandruff theory is that the disturbance responsible for the formation of dandruff gradually extends into the depth of the hair follicle, finally destroying the base by which the hair is nourished and from which it grows. Now it may be true that excessive dandruff plays some part in hastening the ravages of baldness, once the condition has begun. There is no question but the correct treatment of the scalp directed toward the disturbance which causes the dandruff will retard the encroaching spread of the bald spot; but it cannot prevent the ultimate outcome.

DANDRUFF has been so vehemently denounced by eminent authorities as the cause of baldness that it is about time that a few words be said in its defense. In the first place, dandruff is equally common among men and women, but baldness is very common among men and very uncommon among women. It has been urged that the reason for this disparity is to be found in the much greater care with which women attend to their scalp and hair. But any social worker can tell you that baldness is just as rare among certain classes of female immigrants who (Continued on page 144)

New Penmanship Makes Your Writing Readable

HOW good is your handwriting? Do you have a system all your own with flourishes, crooks and dashes that give your friends and business associates brain fever when they try to decipher what you pen? Perhaps a typewriter has come to your rescue.

For some time, teachers, business executives, and, in fact, almost everyone have realized that the number of really good writers has become exceedingly small. Among those who have suspected that the style of writing has something to do with it is Miss Frances M. Moore, a teacher in New York City with many years' experience as an instructor in penmanship. Not long ago she began introducing a new system imported from England called "broad-edge pen writing."

In appearance, this new penmanship looks like printing—each letter is made distinct and separate from every other.

Perhaps the greatest advantage of the new-old handwriting is the ease with which it may be learned. Besides the remarkable results which have been achieved in children's work, there is further very interesting evidence of this in the large number of people who have worked out for themselves a writing of this same type.

Easier than Script

Miss Frances M. Moore, New York school-teacher, and a sample of her ingenious new method of handwriting by which the letters are printed with a broad-pointed pen. It can be written rapidly and is easier than script, she says



In the old days, monks used this kind of lettering in copying manuscripts by hand. Their beautiful products are admired universally.

Through actual tests made with her own pupils, Miss Moore has found that they can write this way as rapidly as when using the ordinary script. Miss Moore comments on the ease of the writing

in a letter to POPULAR SCIENCE MONTHLY, part of which is reproduced with the accompanying photograph, to show a specimen of her own broad-edge pen writing. Continuing, she writes:

"Left to ourselves, we seem naturally to adopt the simple letter forms used by the scribes in the days when writing, though even more important as a tool than in this age of printing presses, typewriters and adding machines, was yet looked upon as an art. We seem instinctively to appreciate the union in the old writing of the practical and the beautiful."

Children usually learn to print before they learn to write, and find

it easier than script. Some persons—Thomas A. Edison is one example—have worked out systems of printing all for themselves. All of which goes to show, Miss Moore contends, that printing is the natural mode of expression.

Under this system, a child learns only one alphabet—the printed one, and it is impossible for the writing to be scribbled.

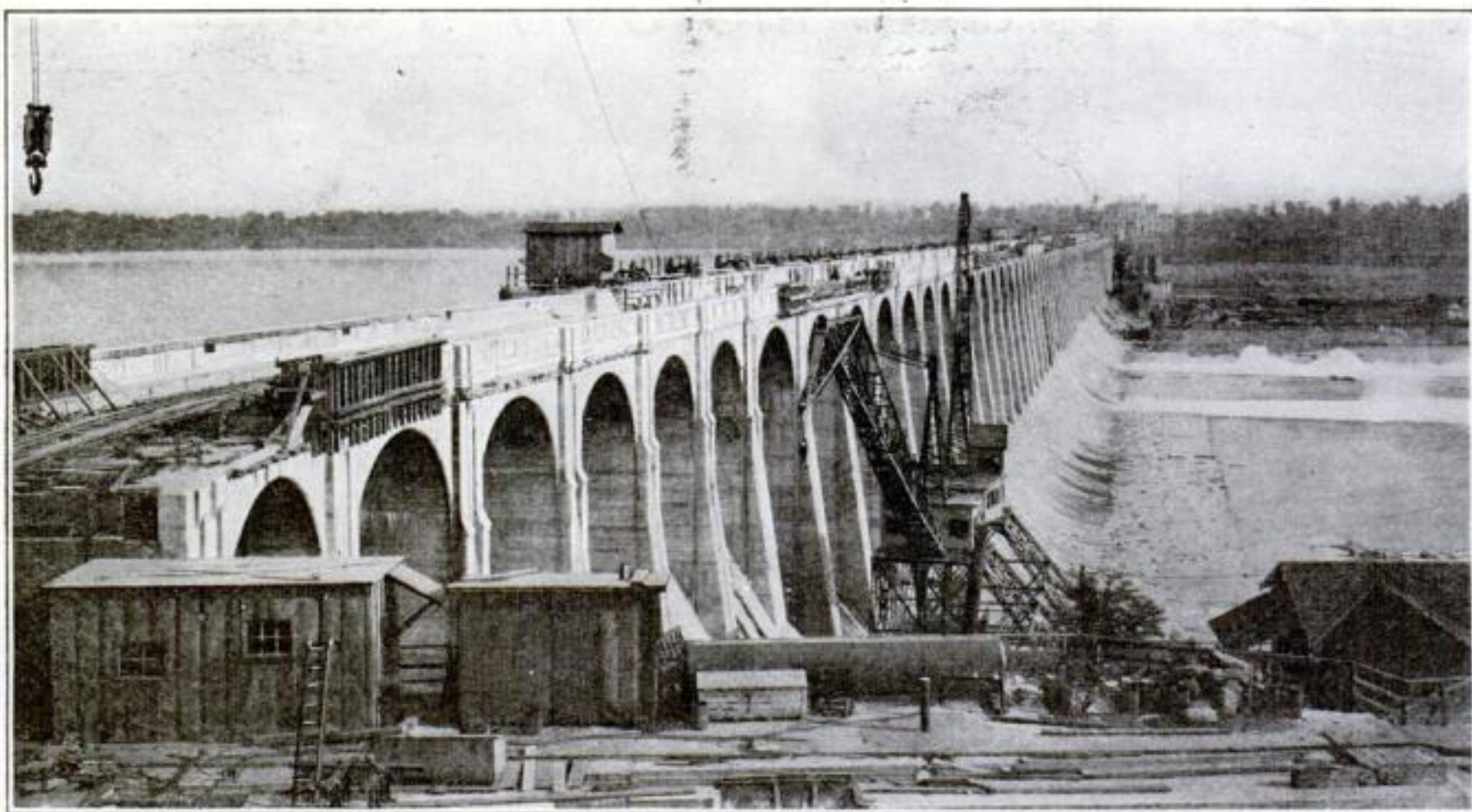
A Bear Hunt 20,000 Years Ago



Copyright "Illustrated London News."

IN PREHISTORIC deposits at Predmost, Czecho-Slovakia, Prof. D. K. Absolon of Prague University recently uncovered the bones of a number of Pleistocene cave bears, huge animals, that often reached a height of 12 feet, and that were much more formidable beasts than the American grizzly.

Our artist here shows the primitive men of the Ice Age attacking the cave bear. They began their attack by trapping the big beast in pitfalls. Then, armed with flint-tipped spears and darts, they slew the huge mammoth. The bones found at Predmost show our primitive ancestors were both bold and crafty.



Recent photograph of the giant Wilson Dam at Muscle Shoals, a unit in the Tennessee River super-power project. The 18-mile lake formed by the dam may be seen directly above the structure. The navigation lock is in the foreground

The Power of Five Niagaras

Tiny Drops of Water to Do the Work of 4,000,000 Horses

FIVE times as much power as can be generated by the great dynamos on the United States side of Niagara! Enough to convert the South, with its peaceful corn and cotton fields, into a humming industrial center, and to make of the Tennessee river valley in the southern Appalachian mountains, an American Ruhr.

A system of artificial lakes, and the deepening of the Tennessee river so that ships may travel from Knoxville through the Ohio and Mississippi rivers to the Gulf of Mexico. A ship canal from the Tennessee river to the Tombigbee river to give this vast new industrial country still another port at Mobile, Alabama.

All this is included in a breath-taking project announced recently by Major Harold C. Fiske of the U. S. Army, chief of the Tennessee Valley Power Survey. It has been called the most stupendous single engineering project in this generation. The plan is to build 100 dams on a 400-mile stretch of the Tennessee river between Paducah, Ky., and Knoxville, Tenn., conserving the heavy rainfall of this region. When all the dams are completed, it is estimated that they will be capable of generating, through combined power of



This map shows the location of the vast engineering project which is expected eventually to develop 4,000,000 horsepower from the Tennessee river between Paducah and Knoxville

falling drops of water, the almost inconceivable total of 4,000,000 horsepower.

One thousand miners working diligently every day in the year for four years might be able to produce the six million tons of coal that would be required to generate such tremendous power.

THE South used to be called sleepy, leisurely, sometimes slow, perhaps because these adjectives fitted in with the life of a sunny agricultural land. The average American now can widen his eyes at a picture of this country as one of the greatest industrial centers in the world, with factories working day and night,

steel mills throwing showers of sparks into the air, and ships traveling to the sea, carrying thousands of tons of manufactured products.

The War Department has been surveying the Tennessee valley region for the last five years. Army fliers have made thousands of pictures which, when pieced together, form detailed maps of this promising land of potential power. The flow of every little stream was estimated, and when all of the data was in, the officials learned that in this single valley in the south was concentrated 20 per cent of the entire potential hydroelectric power of the United States.



The powerhouse at Wilson Dam, with capacity for generating 100,000 horsepower. In the foreground is the weir which will measure the volume of water passing from the hydraulic turbine in the powerhouse

The region through which the river winds is rich in natural resources. There are iron, copper, zinc, limestone and marble. And back of these, timber lands and corn and cotton fields—everything needed to support rich industrial cities which, it is predicted, will spring up as soon as the power of the great river is harnessed.

FOUR utility companies already have made applications to the Government to build dams on the river, and 24 of the dams soon will be under construction. The best-known dams now on the river are the Muscle Shoals Dams. One of these, the Wilson Dam, begun by the Government during the war to supply electrical power to take nitrates from the air, is virtually completed. It is one of the most magnificent engineering achievements in the country. Fifty-eight massive gates regulate the flow, from a gentle fall to a roaring torrent. Two great navi-

gation locks 300 feet in length operate like clockwork.

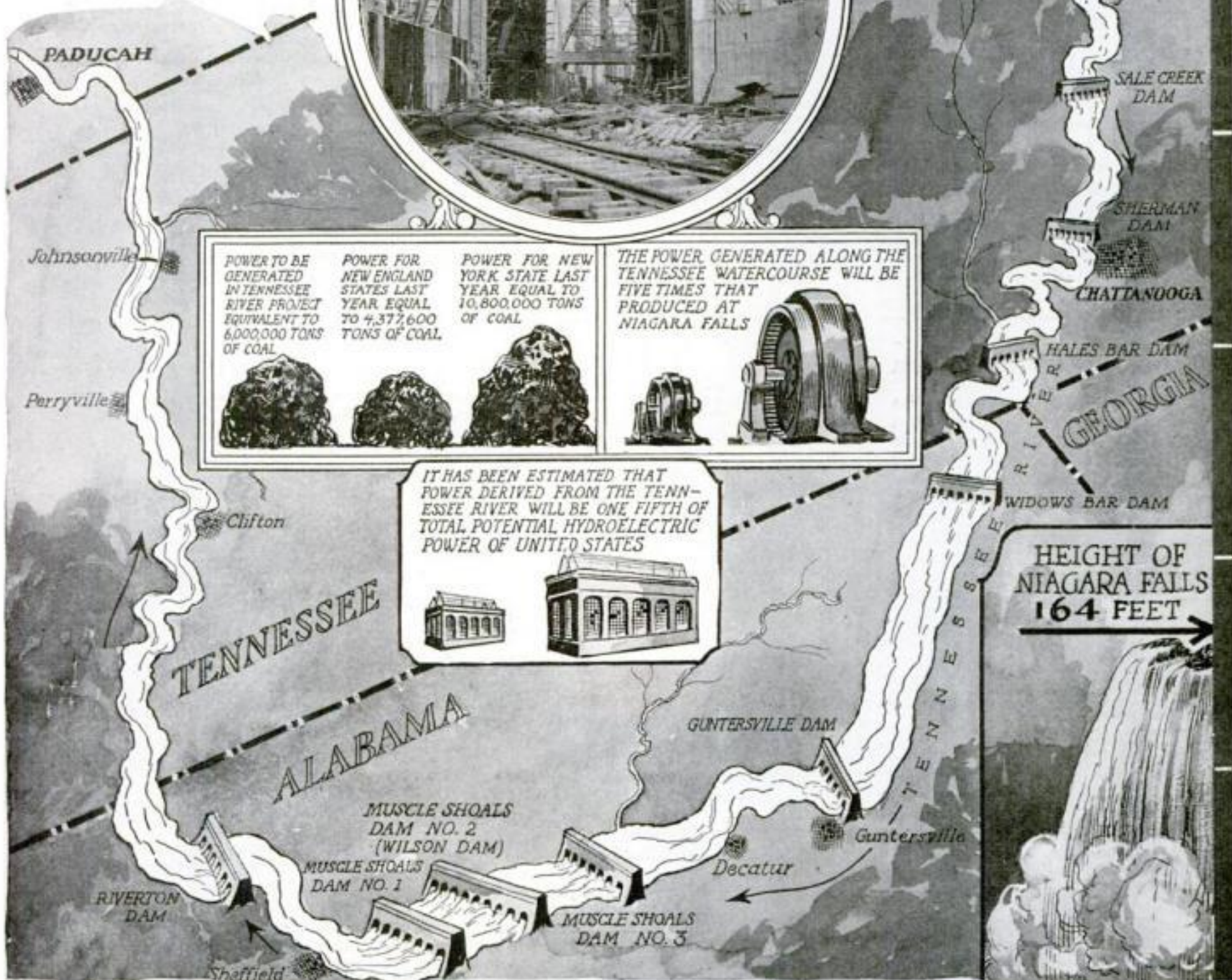
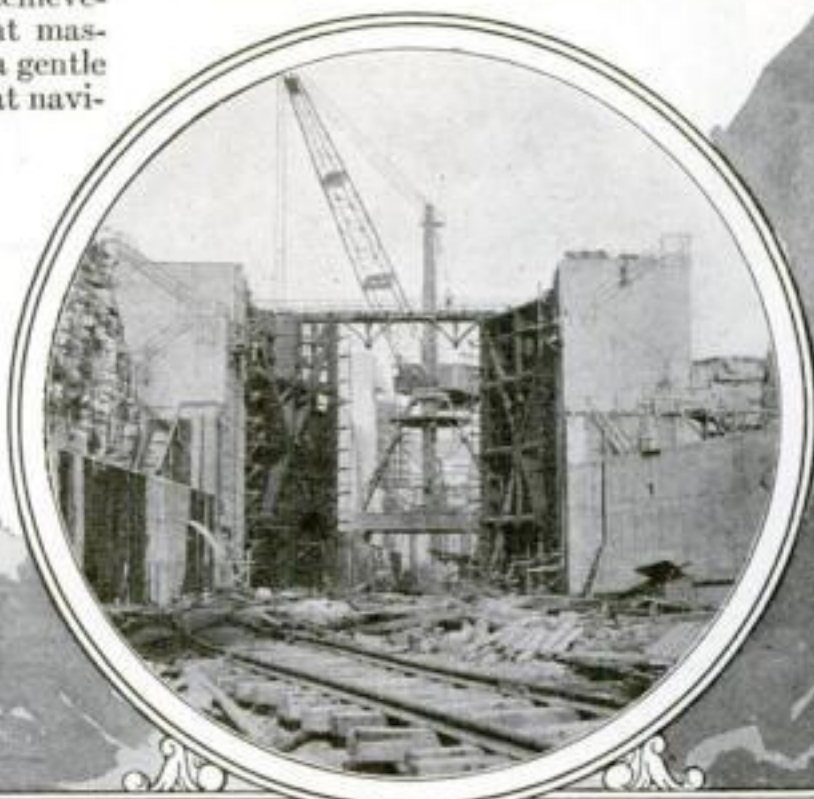
Eight generators now are being installed, but the powerhouse is big enough so that ten more generators may be added when the dams higher up on the stream are completed. With these all working, it is estimated that even at the lowest water stage, Muscle Shoals will be able to produce 100,000 horsepower.

Every dam that is thrown across the river above Muscle Shoals, of course, gives more control of the water at the Wilson Dam. One of the proposed dams, alone, the Cove Creek Dam, during low water season will double the power at Muscle Shoals. This dam will be 250 feet high and form an artificial lake 83 miles long. The huge lake now formed by the Wilson Dam, 15 miles from shore to shore,

and surrounded by wooded hills, looks as if nature itself had planted it in the Appalachians. When the dams are completed, a chain of picturesque lakes will stretch across Tennessee. In this case, industry, rather than making the country ugly, will beautify it. In addition, a national park will be created in this region.

Huge Navigation Lock

At the right: A giant crane at work on the double-lift lock at Wilson Dam. This lock will have a total lift of 96.5 feet, and is designed to encourage navigation on the Tennessee River



Map of the proposed super-power development of the Tennessee river, showing location of projected dams. In the completed project there would be 100 dams producing 4,000,000 horsepower. The

total fall of the river, including all dams, would be virtually five times that of Niagara. In the insets are graphic comparisons giving an idea of the tremendous possibilities for useful power

Five New Ways to Test the Power of Your Mind

Try These Brain Teasers and Measure Your Abilities

HERE are five new ways to measure the power of your mind; five fascinating methods of obtaining an index to your talents and capabilities.

They form the second group of the remarkable series of scientific tests arranged for the readers of *POPULAR SCIENCE MONTHLY* by Dr. Albert Johanson, of the Department of Psychology, Columbia University, according to the principles utilized by eminent scientists in measuring intelligence and supplying vocational guidance.

By means of these tests you can tell in a few minutes in just what directions your mind works best, and where lies the work that is most likely to bring you success.

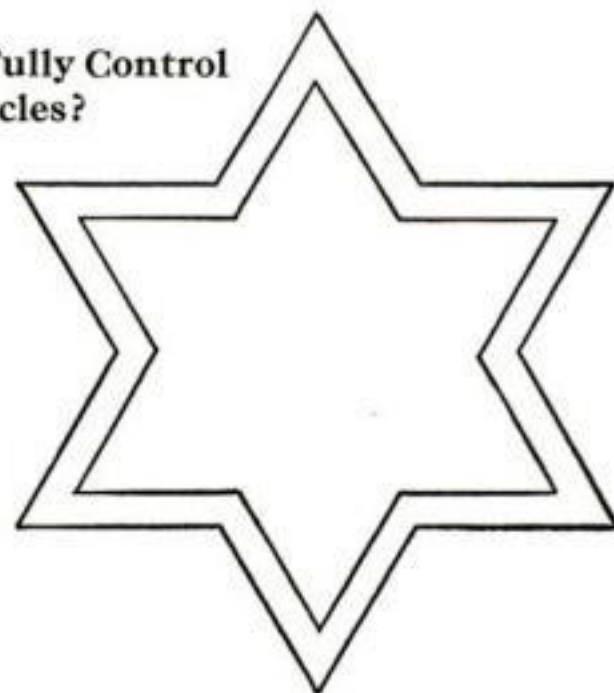
Last month Dr. Johanson offered five tests designed to measure your ingenuity, your imagination, your sense of form and your mechanical skill, your ability to work with numbers, and your sharpness of perception.

This month he offers tests of the co-ordination of your mind and muscles, of your power of concentration, of the elasticity of your mind, of your adaptability, and a new test of your mathematical talent.

Each test offers an interesting problem which you must solve. The solutions are printed on page 146 and with the solu-



Does Your Mind Fully Control Your Muscles?



Cut out this star, and insert in a cardboard box from which the bottom has been removed and place before a mirror as shown above. Looking in the mirror, trace the outline of the star with a pencil between the double lines. If you cross the lines, return to the blank space and continue. Note carefully the time it takes you to make the entire circuit of the star

tions is given a system of scoring that tells whether you have shown superior, average or inferior ability in performing the tests.

In fairness to yourself, though, do not look at the solutions until after you have completed all tests.

The first test, performed with the star shown at the right above, is a test of

co-ordination. Do your muscles obey the dictates of your mind? Are they fully under its control? Can you learn quickly a difficult new process such as driving an automobile, operating a machine, or playing a game? This test will tell you in a few seconds.

Can you concentrate? Can you detect errors rapidly and surely? Try the test

Test Your Concentration

SOME of the answers to the simple examples in addition and subtraction given below are incorrect. The object of this test of concentration is to detect the errors. Work until you have found all the mistakes; then, when you have completed all tests, turn to page 146 for your rating.

$3 + 12 = 15$	$6 + 15 = 22$
$13 + 3 = 10$	$12 - 7 = 5$
$16 - 9 = 7$	$19 - 6 = 13$
$12 - 6 = 6$	$16 + 6 = 22$
$15 - 2 = 13$	$14 + 9 = 23$
$15 + 5 = 10$	$11 + 4 = 14$
$5 + 17 = 22$	$16 + 4 = 22$
$4 + 18 = 22$	$13 - 4 = 9$
$16 - 5 = 11$	$13 - 2 = 11$
$17 + 7 = 23$	$15 - 4 = 11$
$14 - 8 = 6$	$12 - 4 = 16$
$18 - 4 = 12$	$12 - 9 = 3$
$14 + 6 = 20$	$2 + 11 = 13$
$15 - 8 = 7$	$18 - 8 = 10$
$16 + 8 = 23$	$19 - 7 = 13$
$19 + 9 = 28$	$5 + 13 = 18$
$15 + 9 = 25$	$13 - 5 = 8$
$19 + 5 = 24$	$16 - 2 = 13$
$14 - 9 = 5$	$12 + 9 = 21$
$7 + 18 = 25$	$9 + 7 = 17$

How Agile Is Your Mind?

EACH of the English proverbs in the first list below has a corresponding African proverb somewhere in the second list; that is, a proverb that is worded differently, but whose sense is the same. In the blank space beside each English proverb write the number of the African proverb which most nearly has the same meaning. Work for exactly five minutes.

ENGLISH PROVERBS

- a. Married in haste we repent at leisure.
- b. Answer a fool according to his folly.
- c. One swallow does not make a summer.
- d. Out of the frying-pan into the fire.
- e. Robbing Peter to pay Paul.
- f. Birds of a feather flock together.
- g. First catch your hare.
- h. Sour grapes.
- i. Adding insult to injury.
- j. Curses come home to roost.
- k. Distance lends enchantment.
- l. Milk for babes.
- m. We can all endure the misfortunes of others.

AFRICAN PROVERBS

1. One tree does not make a forest.
2. I nearly killed the bird. No one can eat nearly in a stew.
3. Full-belly child says to hungry-belly child, "keep good cheer."
4. Distant firewood is good firewood.
5. Ashes fly in the face of him who throws them.
6. If the boy says he wants to tie the water with a string, ask him if he means the water in the pot or the water in the lagoon.
7. Coconut is not good for birds to eat.
8. He runs away from the sword and hides himself in the scabbard.
9. A fool of Ika and an idiot of Iluka meet together to make friends.
10. The ground-pig said: "I do not feel so angry with the man who killed me as with the man who dashed me on the ground after."
11. Quick loving a woman means quick not loving a woman.
12. If the stomach is not strong, do not eat cockroaches.
13. No one should draw water from the spring to supply the river.

at the lower left-hand corner of this same page, and discover these important facts about yourself.

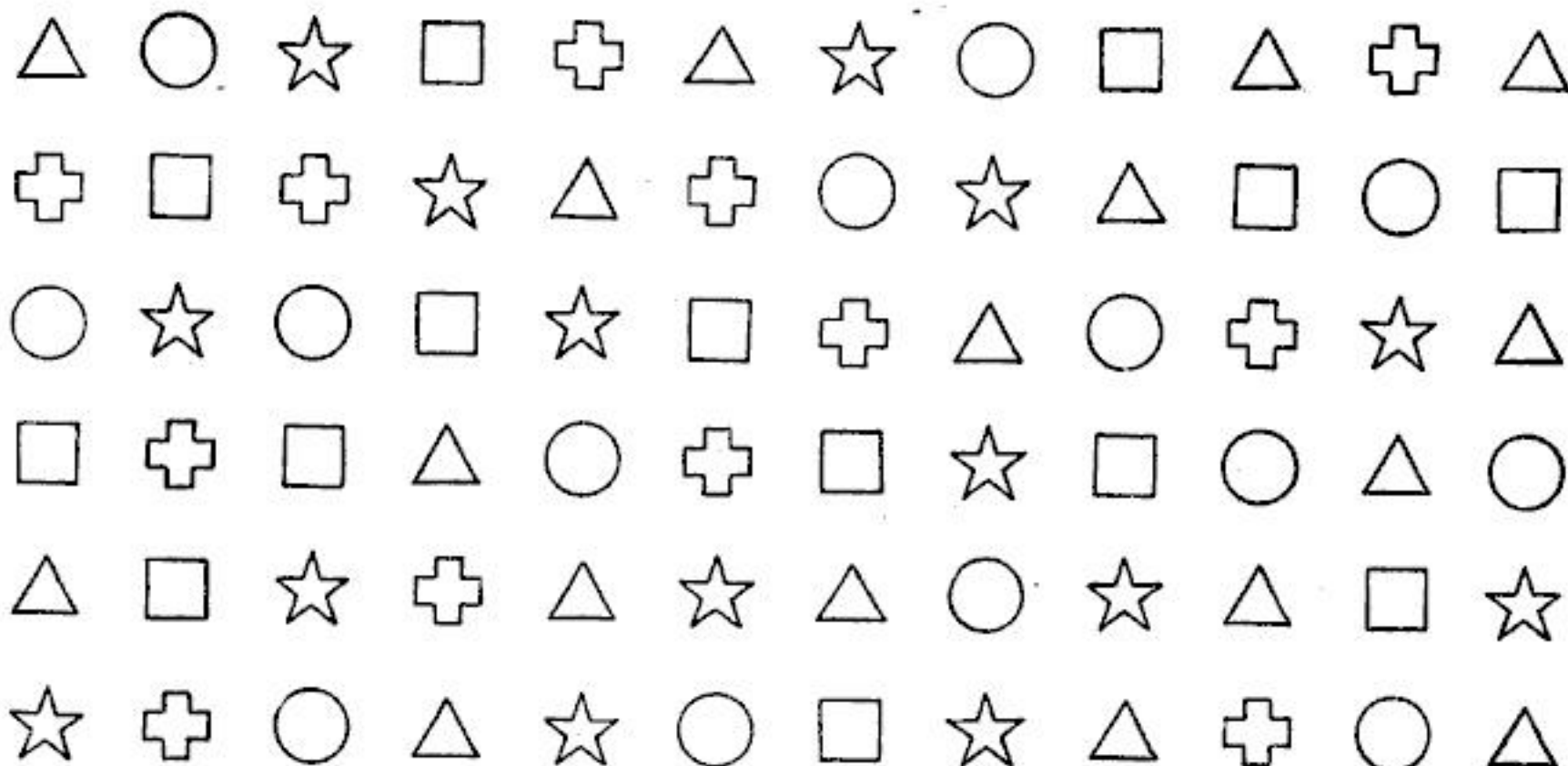
Do you form new associations easily? Can you learn a foreign language, or the details of a new occupation? The proverb test at the other side of the same page will supply the answers to those questions.

Are you adaptable? Is your memory good? Do you learn quickly, especially in regard to form? Would you, for example, be likely to succeed as a hotel man because you can remember faces? Or would you be able to remember the location of the stock in a large store? The symbol test just below will quickly

indicate your talents in these directions.

Somewhat similar in its purpose to this test and the previous one is the code test at the lower left-hand corner of this page. Try this test, obeying faithfully the rules, then pass on to the next test, in the right hand corner, which is a measure of your mathematical ability.

Is Your Memory Good, and How Rapidly Do You Learn?



Study the five symbols at the top until you feel sure you know what number each contains. Note the time, then write into

each symbol below the appropriate letter—in each star a 1, and so on. When you have finished, note how long it took you

See How Quickly You Can Do This One

1 2 3 4 5 6 7 8 9 0
C J L S T U V X Z O

ABOVE are ten letters, each of which is indicated by one of the ten digits. Learn which number stands for each letter, then, timing yourself, write in the blank spaces below the proper numbers for each set of letters as indicated in the first two sets, which already are filled in. Work until you have finished, and make note of your time.

C Z J T	1 9 2 5	T V J L				S O C J					
J O V S	2 0 7 4	J O C X				L Z J Z					
T V L O		U C V T				V L X S					
C X T O		S O J Z				T Z C O					
V U O S		T X L X				Z J T O					
J S U L		S C S Z				X O T J					
Z S Z C		V X J X				U V C X					
X L T U		U J C L				T X T L					
V U C O		S V T O				S V U V					
J U X L		U L C S				Z U O S					
Z C Z U		J Z T V				L Z T V					
U Z L O		L U J O				S X C U					

Are You Good at Numbers?

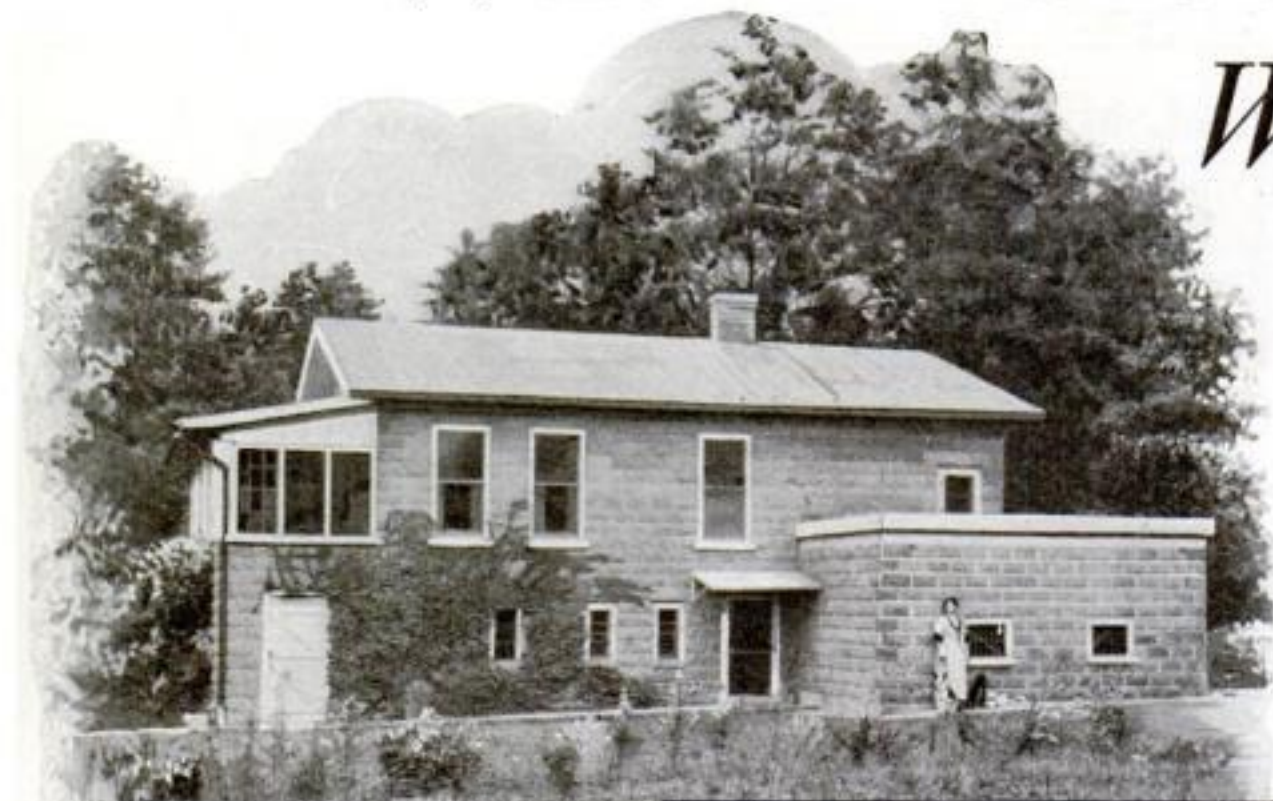
IN each row of numbers below write on the two dotted lines the numbers that should come next to complete the series, as for example 2 4 6 8 10 12. 14. 16 Work for three minutes, then stop and turn to page 146 for your rating in all tests.

2	4	6	8	10	12	14	16
2	3	4	5	6	7		
10	9	8	7	6	5		
5	10	15	20	25	30		
6	9	12	15	18	21		
8	8	6	6	4	4		
3	7	11	15	19	23		
9	1	7	1	5	1		
4	5	8	9	12	13		
25	25	21	21	17	17		
1	2	4	8	16	32		
21	18	16	13	11	8		
12	14	13	15	14	16		
16	12	15	11	14	10		
25	24	22	21	19	18		
16	8	4	2	1	1/2		
3	4	6	9	13	18		
1	4	9	16	25	36		
15	16	14	17	13	18		
21	18	16	15	12	10		
4	8	10	20	22	44		

Mistakes I Made When I Built My House

*Why my floors creak
and floods threaten
the basement—How
I almost asphyxiated
my family—Pitfalls
that you can avoid*

By JOHN R. McMAHON



"The House that Junk Built"

A side view of Mr. McMahon's home, showing the faultless garage in which he says he realized all the ambitions for perfect construction which he did not quite achieve in his dwelling. This garage is entirely fireproof as well as convenient.

TWELVE years ago I built a house, and entwined about it some magazine articles and a book called *The House that Junk Built*.

Now I shall make that house confess its secret sins, bare its vitals to the world, expose the skeletons in its scanty closets, tell how it might have been a better house if the amateur builder had not forced it to take the first wrong step; in short, inform and warn others of the more or less hideous pitfalls that await an innocent little home-schemed domicile which rambles down the corridors of time.

It is a proverb that the amateur's first house is too small, his second too large, and his third just right. That's my defense, if I need one. I have done only the first. Yet with only one life to live, I don't know what I could do with two more houses. The present dwelling shelters me pretty satisfactorily. My family is used to it. Our two dogs like it. Having made our abode here for one decade, we may as well keep right on, while amusing ourselves from time to time, with it-might-have-beens.

We amateur builders who, according to the last census, are almost as numerous as inventors, ought to coalesce in a fraternal society with an annual outing and games at Atlantic City or Coronado Beach. We could draw on the sand our home designs, even build little



With All Its Faults, a Real Home

Even though the floors may creak, the writer's home, he says, "shelters me pretty satisfactorily." Here is the comfortable living room, with a broad fireplace flanked by shelves of books.

sand models of our dwellings, and fraternally compare their merits, having enough policemen on hand to avert homicide. How the sand would fly! We old builders would unbosom to each other, boast of

his plans, allowing for happy inspiration or misfortune. He is his own contractor and engineer. He buys his own material, hires and fires labor at day's wages. He is his own foreman. He should work on the job himself at least half the time; and in such activity the logic of his inexperience usually gives him the status of common laborer or apprentice to his staff of skilled mechanics. Thus the owner at one moment voices a sharp order to his mason employee and the next moment the mason retaliates by snapping at the boss, "More mort!" Neither one dares to go too far with the other. It is ideal. My men and I used to enjoy calling each other down.

"The House that Junk Built" puts me in a fix. I must confess that either the title or the house is "off." I exonerate the house, which deserves no such stigma, and

Don't Miss This Unusual Series

THIS is the first of a remarkable new series of helpful and entertaining articles on home building by one of the country's recognized authorities on the subject.

From his own experience, Mr. McMahon describes here some of the errors and pitfalls into which the amateur builder is likely to fall. In subsequent articles he will explain, in detail, points about home ownership that you have wanted to know. Whether you're planning a house of your own or not, you'll be interested in what he has to say about such problems as designing a home, supervising its construction, making alterations or additions, and keeping it in good repair. In the dozens of little "kinks" he suggests, you'll find much of practical value.

Watch for the second article of Mr. McMahon's unusual series in next month's issue.

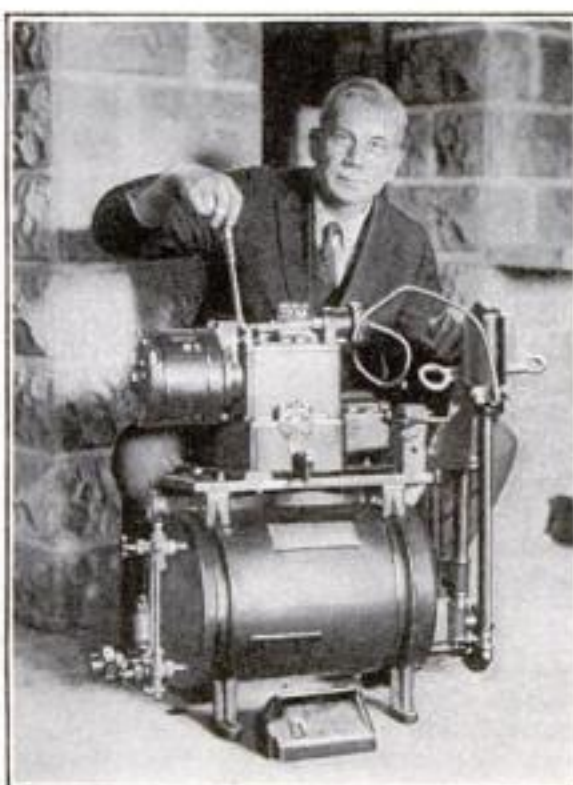
admit a slight deception in the title for drawing purposes. The so-called junk is merely a quota of second-hand building material, most of it equal to new. I have found, like others, that bargains should be studied for a week before purchase. Not because of hidden inferiority but because the labor cost of adaptation often outruns the saving. Junk is a temptation. Unless you have estimated closely its use—whether it's lumber, bricks or steel—avoid the bargain.

THE junk in our house that I most regret consists of floor beams. They came from a bridge. Strong? They would uphold a freight car, being 3 by 10, long leaf pine, on walls or steel girders of 8-foot span. Yet I spaced them too widely for a creakless floor. Their principal fault is esthetic, to an observer who stands in the north end of the basement and looks up. He then sees the sides of those bridge planks scuffed by innumerable hoofs, and he can almost hear the hollow thudding klipklop of steeds that used to race over the river. I wish those planks were more tidy. I would cover them with a ceiling, only the exposed beams are too useful for hanging up tools besides affording the advantage of accessible plumbing, water pipes and electric cables.

Floor joists should be 2 by 10 inches, spaced on 16-inch centers, with diagonal braces or "bridging" every eight feet or so. Then it is well to have a subfloor—which we haven't—of common boards beneath the top wearing surface. This makes for warmth and rigidity. A frame house is extra stiffened throughout when the subfloor is laid diagonally. But it is never too late to mend, at least partially, and you can always put a new top floor on what you have.

I scorned the superficial when I built. Not looks but strength was my motto. Time has mellowed that point of view and I am now willing to concede that those artist friends who hinted at the ugliness of rock-faced concrete blocks meant to do me a service. Today Nature and a daughter of her who invented aprons have amended the rugged nudity of our walls with robes of green and

He Is His Own Mechanic



Mr. McMahon at work on the electric pump in the basement of his home—this was not part of the "junk" that built his home

festoons of flowers. Our house's crude strength is dolled up, even perfumed in due season. 'Tis well—but when intelligent visitors come, I lead them to the basement and have them, so to speak, feel of the muscles of our house. They generally say "Oh, my!" at our two steel girders, and a few of them understand the excellent masonry of the walls.

Here a cardinal confession. I lacked supreme faith when I built. I risked my all, but I should have gambled further with my neighbor's, or at least the building-and-loan's wealth. I had the vision of a perfect house, entirely fireproof. Through shortage of funds I compromised on wooden floors, partitions and roof. It was cowardice. I pretended that I did not care to be in debt. I was too proud to borrow. For the rest of my days, this semi-fireproof house will sneer at my chicken-heartedness. If we had gone in debt, we could have wiped it out a few years after the event. We could not have lost on a better house even if our circumstances had not improved. At worst, in a forced sale, a better house returns more proceeds.

My Twelve Worst Mistakes

1. Lack of nerve to borrow money so as to build a better house.
2. Spacing floor joists too far apart. My floor will support a freight car, yet it creaks.
3. Failure to provide a subfloor, for warmth and rigidity.
4. Neglect of outside drainage problem.
5. No overflow vent for cistern.
6. No cinder base under concrete floor in basement. Failed to use level in building the floor.
7. Did not plan for screening and glassing sleeping porch.
8. Lack of ash dump for open fireplace.
9. No outside filler for the ice chest.
10. Fruit shelves, attached to wooden plugs in wall, collapsed, with great mortality of glass-canned tomatoes.
11. Shy of closet room—of course.
12. Almost asphyxiated my family by labyrinth of pipes that filled house with exhaust from the gas engine.

STILL and all, I do not lie awake nights bemoaning my prudence and lack of genius to adventure greatly. I know my limitations. If I had borrowed, I would have died five or six deaths worrying about the mortgage. Let those who are braver cast the first stone and take larger chances. I proclaim my weakness, and egg on young amateurs to spend enough money on their dwelling. This is not advice to splurge on the decorative, but to spend with judicious liberality on essentials.

My next—imaginary—house will have outer walls of smooth-faced concrete blocks, stone, brick or hollow tile. The partition walls must be gypsum block or hollow tile or concrete on metal lath. The floors will be hollow tile. The roof demands metal covered with concrete slabs or tile, mayhap shingles of rigid asbestos or of copper. Our present roofing of asbestos on asphalt has all the characteristics of a gold-plated wedding ring: it has exceeded its ten-year guarantee but can never become an heirloom.



Rugged Ugliness—"Not looks but strength was my motto. Time has mellowed that point of view. Those artist friends who hinted at the ugliness of rock-faced concrete blocks meant to do me a service"



Clothed by Nature—"Today Nature and a daughter of her who invented aprons have amended the rugged nudity of our walls with robes of green and festoons of flowers, and dolled-up our house's crude strength"

Every other amateur builder who has from three to thirty thousand to spend, devises a great and original economy. You have guessed it. He omits the cellar, thereby saving heaps of cash. The inventor boasts of his discovery the first year; he is almost as proud of no cellar as a six-year-old is of a lost tooth. He is sorry for the unfortunates who have sunk money in a useless hole. There is less talk the second year. Deep silence the third winter. And in the fourth summer season passers-by notice a pair of human moles burrowing under that house and piling dirt high on the lawn. "Yes, we are having a cellar dug," admits the owner.

IT COSTS more to have it done that way, and more yet if the house then has to be raised for higher foundation walls. Just to increase trouble along these lines, a certain amateur built a cellarless house on the wrong site, had it moved to the right place and then had a team of moles carve a cellar under shelter of the domicile.

These are real cases, even to the thirty thousand example. The moral is that no house, except in desert or semi-tropical country, should be put up without a cellar. On this point the Italian laborer in our land is better informed than many Americans: he, the mole, laughs gayly as he digs under the fool boss's house; his own humble shack has an excellent sub-story of solid, watertight concrete, and it was made in the beginning. Ask Louie and Joe about this.

Naturally, our house can draw up its self-righteous skirts and declare that it never dreamed of starting life without a cellar, or its equivalent, which is a basement. That basement has as much area as the living floor above. It is a wonderful workshop and storage space, gives room for furnace, lighting plant, ice chest, has a large fruit-and-vegetable division, and an ample separate space for ladders, window screens, and garden tools.

"House, you are boastful. I have seen three inches of water in that model basement: a little more would have spelled calamity, for with the furnace put out in midwinter the pipes would have frozen and we folks frozen too."

MY HOUSE retorts, icily, that this was no fault of its own: the problem was one of outside grading and drainage. A fair excuse, shifting the blame onto an unintelligent owner. I am reminded by the episode how amateur builders ever tread the marge of tragedy and often escape by the skin of their teeth. A broken window pane in ten-below-zero weather ruined a suburban family. One fatal thing led to another, the folks had to move out, the place was sold for a song on a plumber's lien.

I made our main basement floor entirely by myself, mixing the concrete outdoors, hauling it in on a wheelbarrow, dumping the stuff and spreading it with a trowel. It's about three inches thick,



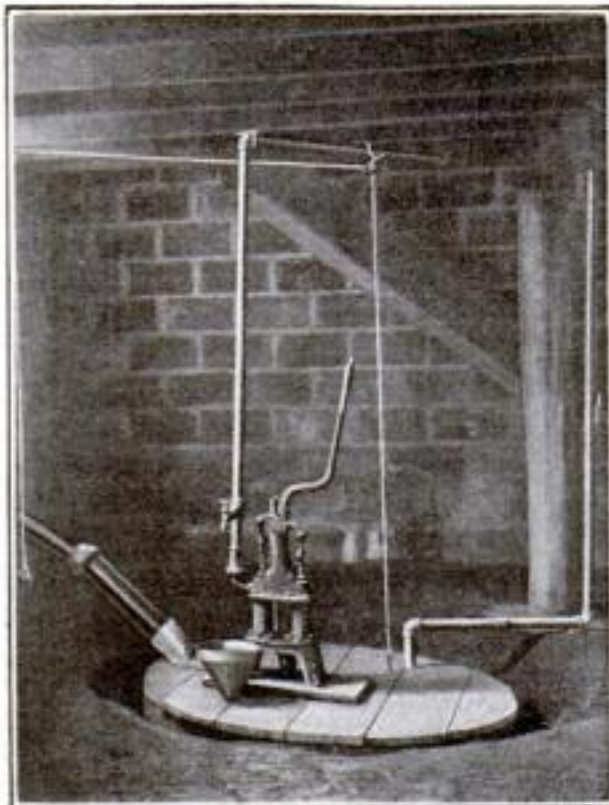
"Friend Wife" Delights in a Good Basement

Here is Mrs. McMahon, tending the furnace in the model basement, which provides ample room for a wonderful workshop, storage space, heating and lighting plants, ice chest, and a fruit and vegetable division

solid enough, but lacks the benefit of line, level and straightedge. (I honestly didn't know then about the use of these methods to secure uniformity of surface.) It also lacks the advantage of a rich top surface above a concrete base. The material is the same all through. Worst of all, it has no six-inch layer of tamped cinders beneath but lies right on a clay bottom. It is sheer luck of the site that the floor is not wet in rainy weather. It merely sweats a little with condensation of moisture in summer, when warm air meets a surface in direct contact with cold clay.

The basement floor, furthermore, has no regular drain such as all ground floors should possess. But again chance has favored us with an accidental drain which consists of the stone sub-foundations of the house walls. It is safer not to depend so much on Lady Luck.

Among our defects is no ash-dump for the open fireplace. Half an hour's work at the right time would have saved me two days of labor upon a makeshift.



Well with Electric Pump

At first the well was equipped with a hand pump, shown above. Now Mr. McMahon has installed an electric pump and has covered the whole outfit with a strong concrete top

Another fault, laboriously corrected, was due to having confidence in a mason's judgment as to the distance between firebrick and wood. What the mason regards as safe should be multiplied by two; then you will have less to worry about.

DOUBTLESS my stupidest botchery concerns our cistern, which is in the basement and quite ingeniously built above a well. Exhausted by the feat of so placing a cistern, it never occurred to me to give it an outlet. As Archimedes once observed, "What enters must equally exit." He was right. The darn thing periodically overflows. Someone screeches, someone dashes bare-headed into the rain to shut off the dingus at the corner of the house. Then to sweep

away the mess of surplus moisture into basement drains. It's hateful, even while I marvel at the hydraulic lesson of a weighty concrete manhole cover flung upward by the might of water.

I have put in days drilling concrete inside and digging earth outside in the effort to give that wretched cistern a vent. So far I have been baffled by an unfavorable grade and, more lately, intimidated by an incidental consequence of my toil.

I had developed a maze of outer and inner pipes serving roof water, ice chest, cistern, and exhaust from the gas engine of the electric light plant. These pipes were so interconnected that only a mathematician could have understood their exact relations and foreseen the possibilities. Thus civilization, 'tis said, becomes lost in its own labyrinth. Be that as it may, while the electric light engine was running, I noticed that our cat, Horace, lay in a faint with extended legs. Our bull terrier tottered about glassy-eyed and became seasick. Other members of the family were pleasantly drowsy. Five minutes more of those insidious fumes from the engine exhaust permeating the basement and rising to the living quarters would have painlessly finished the occupants of the dwelling. We opened everything, stopped the engine that was in cahoots with the pipe system to destroy us, and had headaches for half a day.

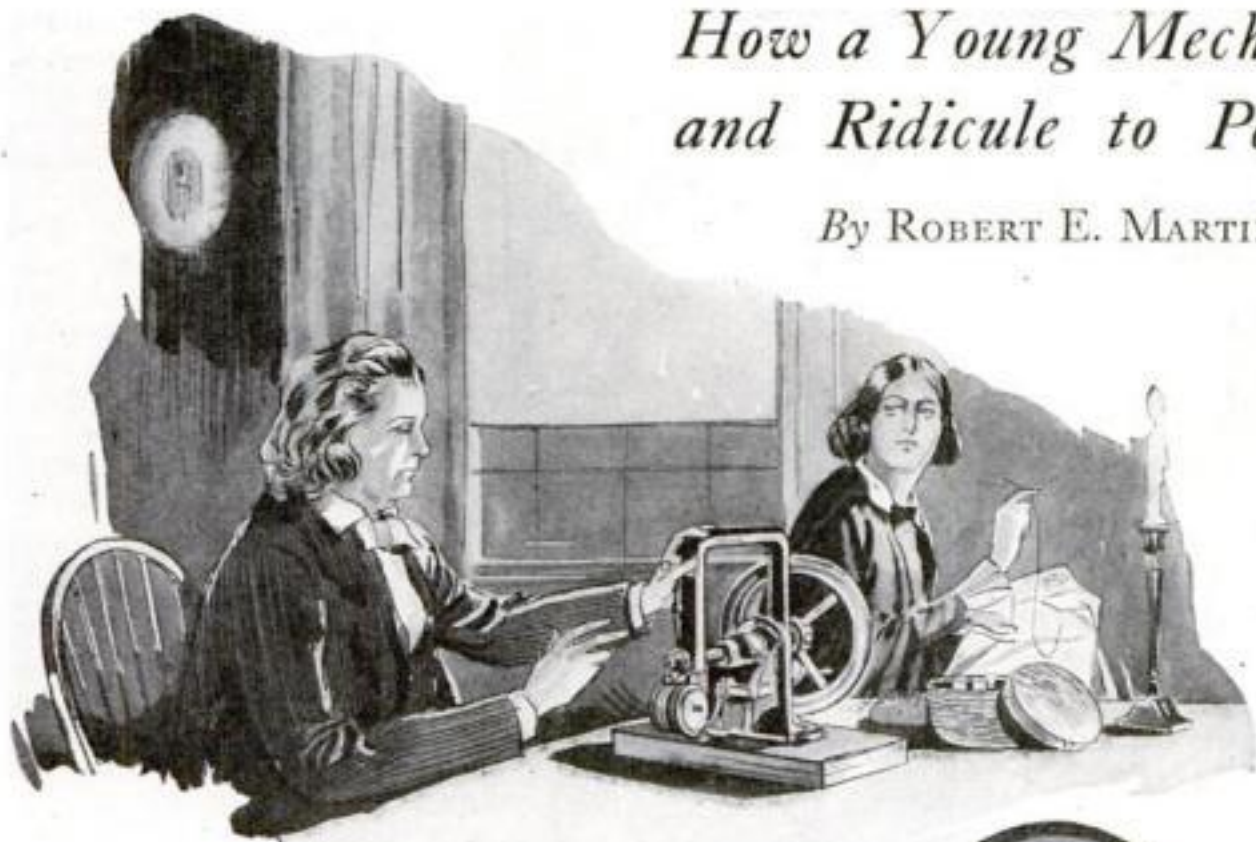
WHEN building our sleeping porch, there was lack of foresight to provide for screens and for glassed sash. The coping wall received a uniform outward slope, but the inner edge should have been flat or level to avoid beveling sash later. A little wire mesh reinforcement in the concrete coping would have prevented cracks. Some scheme for fastening screens and sash should have been devised in advance. Especially troublesome were the porch's round pillars. To fit against their curves, strips had to be carved laboriously and even profanely, and in the end we had to box the pillars in to give a square edge for sash. As for the abnormal size of our porch screens—some of them being 5 by 8 feet—I am reluctant to admit real

(Continued on page 138)

He Freed Women from Drudgery

How a Young Mechanic Battled Poverty and Ridicule to Perfect a Great Idea

By ROBERT E. MARTIN



Born of Necessity

As Howe, broken in health, saw his wife become hollow-eyed and stoop-shouldered plying the needle, he realized the crying need for the invention of the sewing machine. The result was his first model, shown at the right, of which our modern sewing machines are the descendants

IN A back alley in Boston a hundred years or so ago, a man named Ari Davis rented a small shop, installed a few tools and machines, and hung out a shingle containing his name and the single word "mechanic."

Today we would call Davis a handyman, possibly even a jack-of-all-trades, for he wielded paint-brush or hammer, file or awl with equal readiness and equal facility, and cared little what was the nature of the job he was asked to do provided his patron was willing to pay for it.

At that time, though, and in that particular community, Davis was regarded as little less than a genius. For the people of Boston then had but two interests—literature and commerce. They had not yet perceived the first faint streaks of the new mechanical age that was about to dawn. It seemed wonderful to them that one ingenious Yankee could almost instantly diagnose and cure the ailments of a stopped clock or errant watch, reset the lenses in a telescope or surveyor's transit, open a door whose key was lost and with a few strokes of a file produce a new key, sharpen knives and skates, solder leaking pots and pans, repair broken firearms and perform whatever other services might be necessary in maintaining the efficiency of the few mechanical appliances that were in general use in that day.

AND SO Davis' fame grew apace. He became celebrated as a man who knew all there was to know about all mechanical matters. A flock of eager young men—inventors, seeking the road to recognition and wealth that had been opened up by the call for machinery for the rapidly growing industries of the nation—thronged the Davis shop to offer for his inspection the models of their in-



ventions, to obtain his advice and opinion with regard to the ideas for inventions they had conceived.

Into Davis' shop one day in 1837 came a youth of 18, a small, thin, delicate-appearing lad, rather shabby and awkward; a country boy, the shrewd Davis guessed immediately. There was something about his young visitor, however, that intrigued Davis' interest, an odd air of dignity, almost of distinction, that caused the mechanic to forget the other's youth, rough clothing, and almost sickly appearance, and to greet him with respect.

"You have an invention to show me?" he inquired.

"No, sir," answered the boy. "I am looking for work."

Davis hesitated. The rush of work that had come to his shop in recent years had necessitated his engaging a staff of helpers. Just then, though, there was no vacancy, certainly none for a young, untrained apprentice such as this applicant appeared to be. And yet that vague but compelling quality that he had noticed in the personality of his caller prevented Davis from sending him away.

"I might have something for you," said the mechanic slowly, and as he uttered the words he was the unwitting spokesman of Fate.



A Real Hero of Invention

Beset by poverty, sickness, ridicule and injustice, Elias Howe fought an heroic battle for his idea and lived to perfect one of the useful inventions of the modern world

For the ungainly but manly and engaging youth who stood before him was Elias Howe, destined within a few short years to invent and perfect the sewing machine, the wondrous contrivance that freed millions of women in

every land from the thralldom of toil and made possible the amazing variety and cheapness of modern clothing and virtually all other textile products, the device which of all those developed in the golden age of invention that began with the nineteenth century is possibly most useful in the life of every human being.

BECAUSE, strange though it may seem, had Davis sent young Howe away that day, the latter might never have invented the sewing machine. It was in Davis' shop that the idea for the machine occurred to him, or rather was thrust upon him. It was in Davis' shop that he acquired most of the skill with tools that enabled him to fashion and assemble the intricate parts of his first machine. It was in Davis' shop, while performing the amazing variety of mechanical tasks for which its proprietor contracted, that young Howe learned resourcefulness, developed his ingenuity and caught the handyman's knack of making whatever materials and tools he had around serve for the job he had to do.

Chance, then, played a conspicuous part in the invention of the sewing machine. Possibly chance may be accorded the leading role, though it was by no means the whole show. There were other elements that make the story of this invention one of the most thrilling and dramatic ever

enacted. In all history no man ever waged a longer and more heroic fight than did Elias Howe in developing the sewing machine from a hazy suggestion casually offered one day in Davis' shop to a working, useful device, foolproof and efficient, capable of being operated by the most dull-witted seamstress.

AND the fight that he fought loses nothing in that it was spiritual and mental rather than an actual physical conflict. For the forces that opposed him were the mighty ones that try and sometimes destroy the soul of man—poverty, sickness, ridicule, neglect, discouragement, injustice, and calumny. His struggle against them supplies a chronicle that is inspiring, epic even. He triumphed, and yet his triumph was but half a victory, for in the struggle he lost much that was dear to him, and an unsuspected ally of his enemies—death—snatched the fruits of conquest from his hand almost at the moment he obtained them.

When young Howe told Ari Davis that he was the son of a farmer and miller of Spencer, Mass., hence accustomed since childhood to working with the rude agricultural and grinding machinery of that day, the mechanic was glad that he had not offered him the brusque dismissal which he habitually accorded to applicants for jobs in his shop. When the boy added that he had had two years' actual experience with industrial machinery—as a hand in a cotton machinery factory at Lowell and more recently as a hemp carder in a machine shop in Cambridge, after the panic of 1837 had closed the Lowell industries—he waited to hear no more, but engaged the boy immediately as a helper, and set him to doing simple repair work.

Quickly he found that he had made no

Where Women Slaves Become Masters



In almost every corner of the world today the sewing machine has come to free women from thralldom of drudgery and long cheerless hours—even in this little primitive African village where two of the native women are seen making the strange machine do their sewing for them

mistake in engaging young Howe. There were better mechanics in his shop, specialists in one line of work or another, but Howe was a lad after his own stamp—a natural-born handyman, who with the same tools and with equal enthusiasm could put a new spring into a broken clock or a new trigger into a damaged gun. Moreover, the lack of coddling which had of necessity accompanied his upbringing as one of a family of ten on a rocky, all but barren farm, had taught him to shift for himself virtually from infancy. He was self-reliant, confident of his own way of doing things. When Davis gave him a job, he never wasted his employer's time by inquiring how he wanted the thing done. He did it according to his own lights and by his own methods—and invariably the results pleased both Davis and his customers.

It was only a few months after Elias Howe joined Davis' staff of workmen that there entered the shop one day a man with a large bundle which he carried most carefully, as though it contained something precious. Removing the wrappings, the man drew out an elaborate contrivance of wood, a triumph of the whittler's art. Moving a lever at its base back and forth, he set into motion the weird assortment of cogs, wheels and driving rods that composed it.

"What is it?" inquired Davis with the suspicion of an amused smile.

"A knitting machine," announced the visitor mysteriously. "It's just what the cotton and woolen mills need."

Davis was an adept at getting rid of enthusiastic callers bearing inventions whose commercial possibilities to his practiced eye seemed negligible.

"You're mistaken," he told the man bluntly. "You're wasting your time. Why don't you occupy yourself with something useful—a—a—sewing machine, for example?"

"That's impossible," cried the man.

"**N**OT at all," responded Davis easily. "Why, I could invent a sewing machine myself—if I only had the time to devote to it. Why don't you try it? It will certainly make your fortune. I'll be glad to examine it when you've completed it."

The visitor departed, promising to carry out Davis' suggestion. The latter, grinning at the success of his subterfuge, returned to his work.

His older workmen, used to their employer's ways, laughed with him. One occupant of the shop, though, saw no humor in what Davis had said. The words "sewing machine" had sunk deeply into young

(Continued on page 149)

A Million Dollars' Worth of Motor Cars at a Glance



How would you visualize a million dollars? Children try to do it by imagining counting goldpieces in a heap as big as a haystack. There is an easier way. Go any place where automobiles are parked row after row, as far as the eye

can see, and there is the million dollars. The remarkable panorama of wealth shown above was taken at Rockingham Speedway, N. H., and gives fair indication that the Granite State is well supplied with automobiles of every make

Mysteries *that* Ride *the* Mails

Strange Objects and Ugly Plots Found by the Dead Letter Office



At left: F. H. Bushby, in charge of the property section of the Dead Letter Office, examining musical instruments and curios which have reached the dead letter office because of faulty addresses

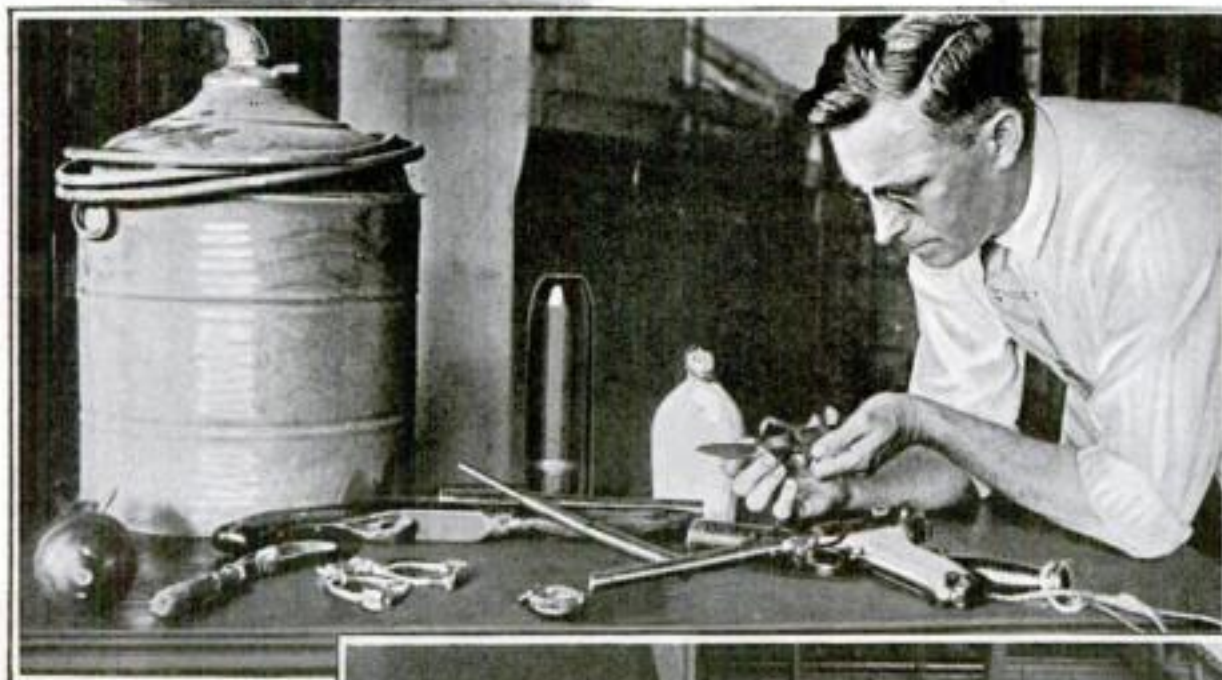
Above: One day's accumulation of "dead" letters—eight full sacks in all. Less than a quarter of them ever are identified

NO PLACE in the world, perhaps, holds as many unsolved mysteries in as many odd forms as does Uncle Sam's Dead Letter Office in Washington.

Not only is this mail morgue the final resting place for letters and parcels that go astray because of faulty addresses, but it is also the repository for contraband goods such as firearms, alcohol and narcotics, as well as deadly bombs and infernal machines. There an ordinary package has been found to conceal enough dynamite to wreck a building. There, too, innocent-looking parcels have given up everything from a live snake or poisonous tarantula to a flock of fleas.

More than 60,000 carelessly addressed letters arrive every day in this government morgue, which received 21,000,000 letters and 803,000 parcels last year. In this number are 100,000 letters which have been mailed in entirely blank envelopes, many containing large sums.

The cash found in misdirected mail amounts to about \$55,000 annually.



Contraband

Firearms, daggers, bombs, whisky stills, and narcotics are often among the illicit goods which reach the Dead Letter Office. F. C. Staley, superintendent of the office, is seen above examining some of the contraband items

Sold at Auction

Each year the Dead Letter Office holds an auction of unclaimed articles such as jewelry, tools, musical instruments, and Bibles. The sale usually nets about \$300,000. At the right Superintendent Staley is delivering a violin to Assistant Postmaster General Bartlett, the highest bidder for it



A Favorite Hiding Place

Poison, narcotics, and liquor frequently are concealed in the pages of a book and mailed. Notice how the book has been cut to form receptacle for bottle

Do Athletes Die Young?

Careers of famous stars in boxing, football, baseball, rowing, tennis and track tend to show that the man who engages in strenuous sport has as good a chance for long life as anybody—The “athletic heart” bugaboo—When it's time to let up

By ARTHUR GRAHAME

IS THE path of athletic glory a short cut to the grave? Are the star athletes of today, in the pride of their youthful strength, placing on their marvelous bodies strains that will leave those bodies easy prey for the ills of middle-aged tomorrow? Do athletes die young?

Even the man who is not especially interested in sports is likely to ask himself these questions when he reads in his newspaper of the death at an early age—or even at a comparatively early age—of some famed athlete. To the man who has taken an active part in sport, such news has something of the warning character of the handwriting on the wall, and comes with the force of a real and personal shock.

Shocks of this kind have been frequent in the last 18 months. Death has recently claimed many who in their day played brilliant parts in the drama of sport. Football has lost Walter Camp at 66 and Percy D. Haughton at 49, both by heart disease. Tuberculosis claimed Christy Mathewson, baseball's best-loved pitcher, at 45; and

Frank Chance, the “Peerless Leader” of the champion Chicago Cubs of twenty years ago, died at 47 as the result of a general breakdown following an operation. Bright's disease killed Robert D. Wrenn, tennis champion in 1896 and 1897, at 52, and Billy Miske, prominent pugilist, at 30. Heart disease cut short at 54 the busy and picturesque career of Ralph D. Paine, Yale oarsman and football player, war correspondent and fiction writer, and the same disease ended, at 45, the life of Myer Prinstein, winner of Olympic events in 1900, 1904, and 1906, and one-time holder of the world's broad-jump record. Many other athletes and ex-athletes, almost as well known, have followed these stalwarts down the one-way trail.

Reading of these untimely deaths, I began to shiver before the bugaboo of the “athletic heart”—for I have been for twenty years a player of various more or less violent games, and although my playing has

brought me neither championships nor glory, it never has been established that being a dub is a safeguard against the dangers of athletics. So when the editor of POPULAR SCIENCE MONTHLY asked me to try to find the correct answer to the question: “Do athletes die young?” I was vitally interested in the task—and a little afraid that the assignment would bring me a bundle of bad news.

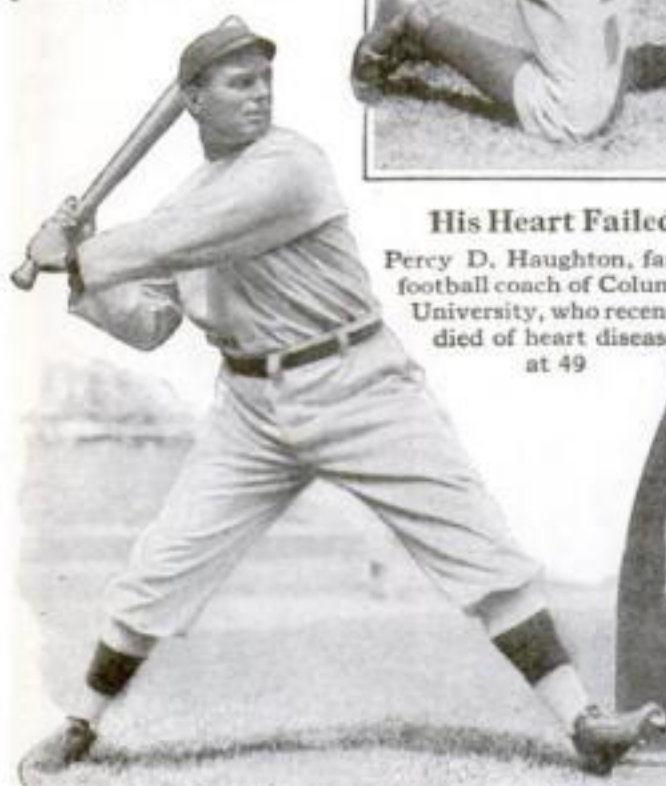
STARTING with baseball, I at once discovered something that holds true in other sports—that the departed athletic hero seems younger than he really was when death claimed him. The Christy Mathewson that we pictured when we heard of his death last fall was not the baseball club officer and war veteran who fought his losing fight against the disease that was a result of his service in France, but the more youthful “Big Six” of the New York Giants who won more than 20 games each season between 1903 and 1914. We remember our sport heroes as they were in the days of their glory—not as they were in the twilights of their careers.

Considered from the standpoint of



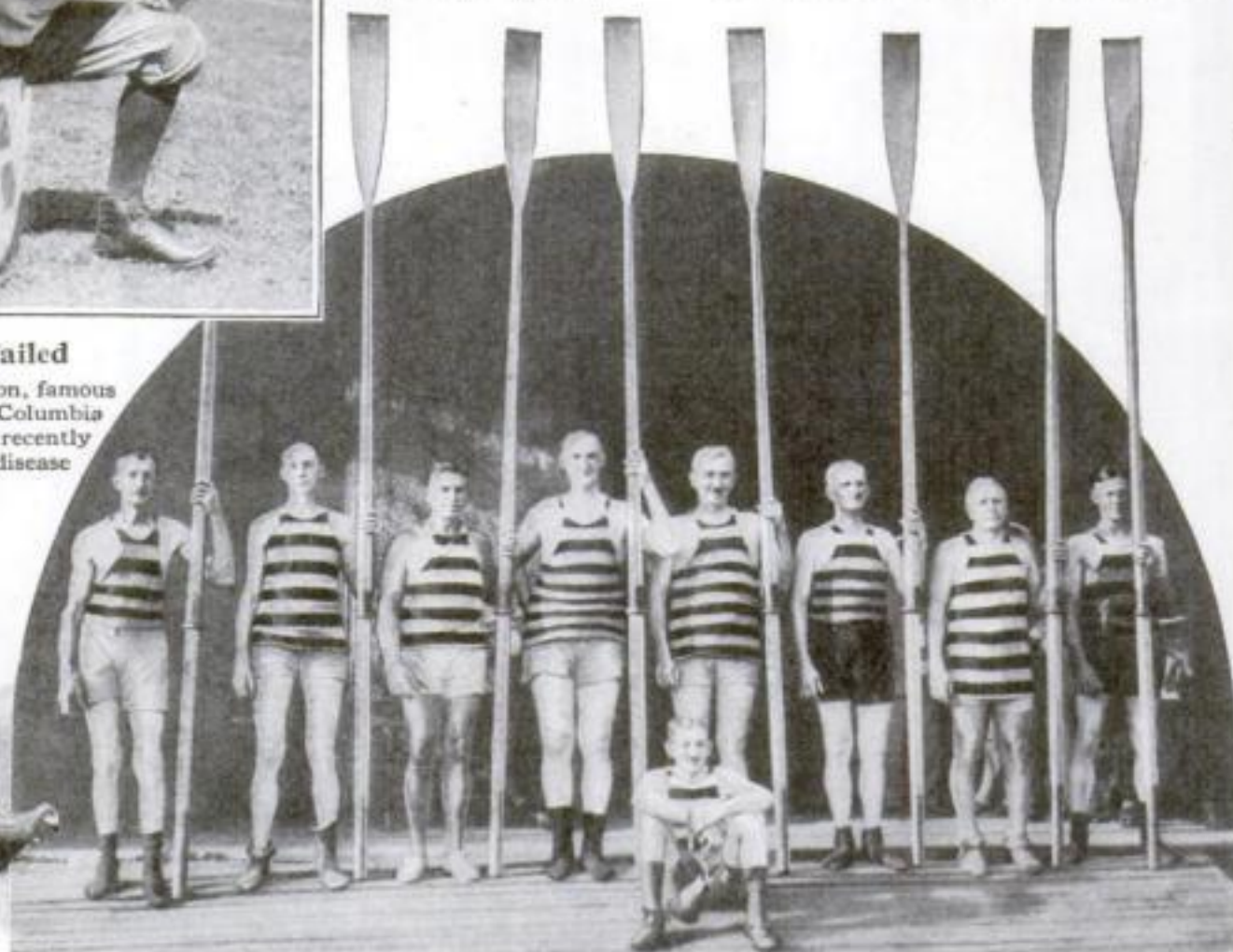
His Heart Failed

Percy D. Haughton, famous football coach of Columbia University, who recently died of heart disease at 49



A Hard Hitter at 54

After 35 years in the game, “Iron Man” Joe McGinnity, old-time pitcher of the New York Giants, is still crashing the ball in a minor league. McGinnity earned his Big League spurs with the Giants more than 20 years ago



Champions of 25 Years Ago Can Pull a Strong Oar Today

Veteran members of the eight-oared shell crew of the Vesper Boat Club of Philadelphia, Olympic rowing champions in 1900. At their twenty-fifth reunion last year, every man was in good enough

condition to pull an oar. They are Roscoe C. Lockwood, Ed Maesh, Edwin Hedley, William Carr, John F. Geiger, James B. Juvenal, Harry L. DeBaecke, J. O. Exley, and Lew Abell, coxswain

longevity, baseball seems a highly desirable career. Frank Chance is dead, but the two other partners in the "Tinker to Evers to Chance" combination are alive and well. The famous "King" Kelly, most versatile of ball players, died under 50, but "Cap" Anson lived to be 70 years old. "Cy" Young, one of the greatest of pitchers, is operating a big farm at the age of 59. After playing baseball for 35 years, "Iron Man" Joe McGinnity, at the age of 54, was pitching in a minor league last summer.

John Montgomery Ward, who broke into big-league baseball in 1877, and retired from the game in 1895 to devote himself to law and golf, died last year at the age of 65, of pneumonia contracted on a hunting trip. "Wild Bill" Donovan had left the 50-year mark behind him when he was killed in a railroad accident in 1923. Billy Sunday, the evangelist, who was a member of the champion Chicago White Sox in 1886, is active at the age of 62. Jake Daubert died in 1924 at the early age of 39 after an operation, but Wilbert Robinson, after a long career as a player, is president and manager of the Brooklyn National League club at the age of 62, and Hugh Jennings, 56 years old, is assistant manager of the Giants.



He Walks Far and Lives Long

Long walks and long life apparently go together. Edward Payson ("Daddy") Weston (right, above) is 88 years old, but he still pulls up fresh after a hike of 100 miles or so.

Walter Johnson, Grover Cleveland Alexander, Ty Cobb, and Tris Speaker are among the many players who still are stars on the playing field although they are close to the 40-year mark. Baseball players, as a general thing, do not die young.

The death of Walter Camp came as a shock to the public, for he had come to be looked upon as the example and apostle of physical fitness. But it must be remembered that Mr. Camp, a man who

carried a heavy burden of business responsibilities, was 66 years old when he died, and as his football playing ended in 1881, it is scarcely just to charge that game with his death.

Football players also seem to belong to a long-lived tribe. It is true, there have been some tragic exceptions, such as Shevlin and Hogan of Yale, who died of pneumonia before they reached middle life, and Haughton of Harvard, who died of heart disease while coaching the Columbia team in 1924. But ten of the 22 players on the Princeton squad at the time of the first Yale-Princeton game were alive on the fiftieth anniversary of the

Olympic Winner

Martin Sheridan (below), New York policeman and Olympic Games winner in 1904, 1906, 1908. Died at 37.



A Pair of Famous Baseball Veterans

John J. McGraw (left), manager of the New York Giants, and Wilbert Robinson, president and manager of the Brooklyn Robins. Their thirty-odd years on the diamond have left them smiling.



Keeps in Training After 71 Years

At 71, Jim Ten Eyck, famous sculler and rowing coach of Syracuse University, rows at least six miles a day, just to keep in trim. This picture shows him, hale and hearty, out for a row on Onondaga Lake, New York.

game, and in 1924 six of the 15 players for Harvard who faced Yale in the first Harvard-Yale game in 1875 were alive. All but two of the players on the Princeton team of 1887 were alive 37 years later, and those two were victims of the war.

Turning to the loosely kept, and not too trustworthy records of pugilism, it is difficult to form any definite opinion about the effect of prizefighting on the length of life of its exponents.

Of the eight men who have held the world's heavyweight championship since 1890, six are alive. John L. Sullivan, the most famous prizefighter the world has seen, died in 1918 at the age of 60, after a career in which hard fighting and harder drinking played conspicuous parts. James J. Corbett, who won Sullivan's championship from him, is active on the stage and still frequents the gymnasium although he is nearing 60. But the conqueror of Corbett, Bob Fitzsimmons, pound for pound the greatest fighter of them all,

died at the age of 56. Jim Jeffries is alive at 50, and Tom Sharkey, the husky sailor who was close to the championship although he never won it, follows the races at the age of 53.

THE great fighters of the lighter classes have been less fortunate than the heavyweights, although Jack McAuliffe, the lightweight champion who retired undefeated, is alive and happy at the age of 60. The original Jack Dempsey, the Nonpareil, died at the age of 33. Joe Gans, the Baltimore negro who once held the lightweight title, died of tuberculosis at the age of 36; "Terrible Terry" McGovern did not live to see 40; George Dixon, a fine colored fighter who held the featherweight championship, died at the age of 39.

Many people think that running is bad for the heart, but available data on track and field sport do not bear out this contention. The wearers of the spiked shoe seem to live about as long as do other

(Continued on page 152)



Jim Corbett Is Still Young

Although he is nearing 60, James J. Corbett (above), former world's heavyweight ring champion and conqueror of John L. Sullivan, hasn't a gray hair in his head. He is active on the stage, and still frequents the gymnasium.



The most recent night photograph along New York's Great White Way, where some 9,000 flashing electric signs turn night into day with the greatest concentration of artificial light to be found anywhere in the world. Today there are more than a million lamps in the signs on Broadway

How a Million Lights Paint the Gay White Way

The Amazing Story of a \$20,000,000 Electrical Display

KEEP the lights alive—at any cost! That's the rule. If this big sparkler went dark for ten minutes, our company would lose \$1,000. But it's more than a matter of money. To keep New York's sky signs flashing through every second of their night life is a code of the game, with us.

"That's why trouble shooters like me are out on the roofs on a night like this."

With my informant, one of the guardians of the white lights of Broadway, I had fled from the storm into what he called the control shack. It crouched beneath the skeleton of a monster electric sign-board whose light would illuminate all the homes in a town of 10,000 population. That sign fetches a bigger rental than all the stores in the building above which it towers 50 feet into the night. It cost \$20,000 just to build; it contains two miles of electrical wiring, and its message is written in 3,000 ten-watt tungsten lamps.

From the theater streets below, more people could have seen that sign in the preceding 24 hours than live in the cities of Washington, D. C., and Portland, Ore., combined. It is one of 22 so-called "spectaculars" which if put together would make nearly two acres of dazzling brilliance. These tremendous flashing jewels shower Broadway with the greatest concentration of artificial light to be found anywhere on the earth's surface.

By MARSHALL D. BEUICK

Outside the operating hut where we shivered and talked, a biting gale swept down from the Hudson. Crowning the five-mile luminous chasm on the crest of which we were perched, the great signs that have made night on Broadway a spectacle unique in the world were flashing in kaleidoscopic restlessness. They seemed to be myriad in number, but an actual count shows that the great blaze over the 25 blocks of the theater district, including side streets, is made by barely a thousand major signs. In all Manhattan there are nearly 11,000 electric signs, of which 9,000 are to be seen along Broadway from its lower end at the Battery up to 135th street. About 2,000 of these are on restaurants, and 500 on theaters. There are more than a million lights in the signs on Broadway alone.

On the pavements 100 feet beneath us, there swarmed multitudes of black figures—part of a nightly audience of a million human beings for whose benefit my friend was tonight on guard to see that no single ray should fade amid this 25,000,000 candlepower of golden glamour.

The interior of the control shack echoed with the sputter and thud of automatic switches. The grinding mutter of revolving drums and the thumping of big magnets rose above the whistling

of the gale. I felt rather as though I had crawled into the steel entrails of some giant automaton, and were watching his mysterious life-processes at work. Rhythmically an uncanny blue glare flared up and died—revealing an apparent utter confusion of apparatus and switches and tangled wires.

"It makes a novice feel dizzy," I remarked.

"Well," admitted George, the trouble shooter, "it is a bit confusing. No use trying to explain exactly how it all works. To follow the miles of wiring and study the details of switches and circuits and fuses would drive you crazier than trying to solve an acre of cross-word puzzles.

THE current for one of these huge signs is directly controlled by contacts on that revolving drum, or a set of such drums. There may be ten or twenty of them, in the big signs, all going at once. You can see that the drum is driven by a geared motor. The contacts are made of just the necessary length and placed in just the right spot to keep certain lamps on the sign lit for a set period of time. It works much like the old music boxes with cylinders and spikes that struck chords as they turned; only these cylinders play lights instead of musical notes. The rest is just a matter of wiring.

"These drums are all made-to-measure

in the electrical shops before the sign is erected. The electrical sharks in our laboratories can figure out on paper, with amazing accuracy, just how to arrange the drums and contacts so as to get the exact effect the sign designer pictured in his original sketch. In the spacing of those metal strips that you are looking at on the drum, these experts visualize the whole shifting picture that is operating above us. When you realize that the changing messages of the sign are made of thousands of lamps operating on dozens of circuits, you can see that some pretty clever electrical engineering was necessary to put this sign into operation.

"YET the whole problem is all so completely worked out in advance that I've known the actual construction on one of these signs to start on a Monday morning, with crews working like mad, and a week from the next Tuesday evening I've seen the completed advertisement add its colors to the scenery out there."

In a lull of the storm George drew me outside, and we looked over the parapet of the roof.

"That whole spectacle may look to you like a haphazard jumble, but it isn't. Notice how each sign stands out from its neighbors in contrasting colors, as well as in shape and motion. Those signs

Flash Control

The revolving drum below controls the flashing of the lights, making electric contacts at exact intervals to give the desired effect in the sign



A Huge Letter of Lights

Electricians wiring one letter of an electric sign (above). Sometimes a sign has two miles of wiring

to paint with light according to their own ingenious plans. Some of them are constantly walking the street

at night to study its possibilities and to make notes for possible improvements.

The expense of the big signs is so great that enormous pains are taken in designing them. Before actual construction begins, a preliminary drawing, worked up in color, is made. Then, a small working model of the sign, accurate in every detail, is built of metal. Tiny lights flash the message exactly as the Broadway crowds will see it later, written 60 feet high in 2,000 tungsten lamps on 10,000 square feet of steel scaffolding.

And then a motion picture of the model is made while it operates. This film of the miniature flashing sign is surprinted in the proper black void on a night-time motion picture of the actual Broadway scene. When the manufacturer sits down in a projection room to be shown this film, he seems to be witnessing by magic the nightly display of his future "spectacular" over Times Square, weeks before a stroke of work has been done to erect it on its perch.

LARGE stocks of bulbs have to be kept on hand in the control shacks, because the bigger signs, like the famous chewing gum sign which had 17,000 lamps, eat up replacement bulbs by the hundred every week. Each night before the signs flash on, an inspector goes over them, testing connections with a voltmeter, replacing any lamps that a darkened glass indicates have only a few more hours to live. Other troubles may result from short circuits caused by weather-worn insulation or corrosion of old lamp sockets.

George told me that the job of the men who erect the signs is almost as simple as a boy's job of construction with a toy outfit. The iron workers put up the frame first with pieces of material that already have been cut in standard sizes in the shops. The pieces are marked in the shop, and drilled for bolts so that very little riveting needs to be done.

Sometimes the workmen get a thrill

(Continued on page 154)



A Printed Page of Steel

Structural iron workers fastening the great letters of a sign to the framework of steel. Construction of some of the largest signs costs from \$15,000 to \$200,000

haven't sprung up aimlessly, anywhere and everywhere that some enterprising advertiser could get foothold for a steel skeleton. No, Broadway has been scientifically charted. There used to be a ceaseless battle to capture dominating positions, but now one company practically controls the whole show, at least as far as most of the best locations are concerned. Our firm holds many unused leases on every available building where a sign might conflict with one of the existing signs. It costs nearly as much to keep black holes in the sky as to fill other spots with light. We may pay \$5,000 for a single roof on which we never expect to erect a sign.

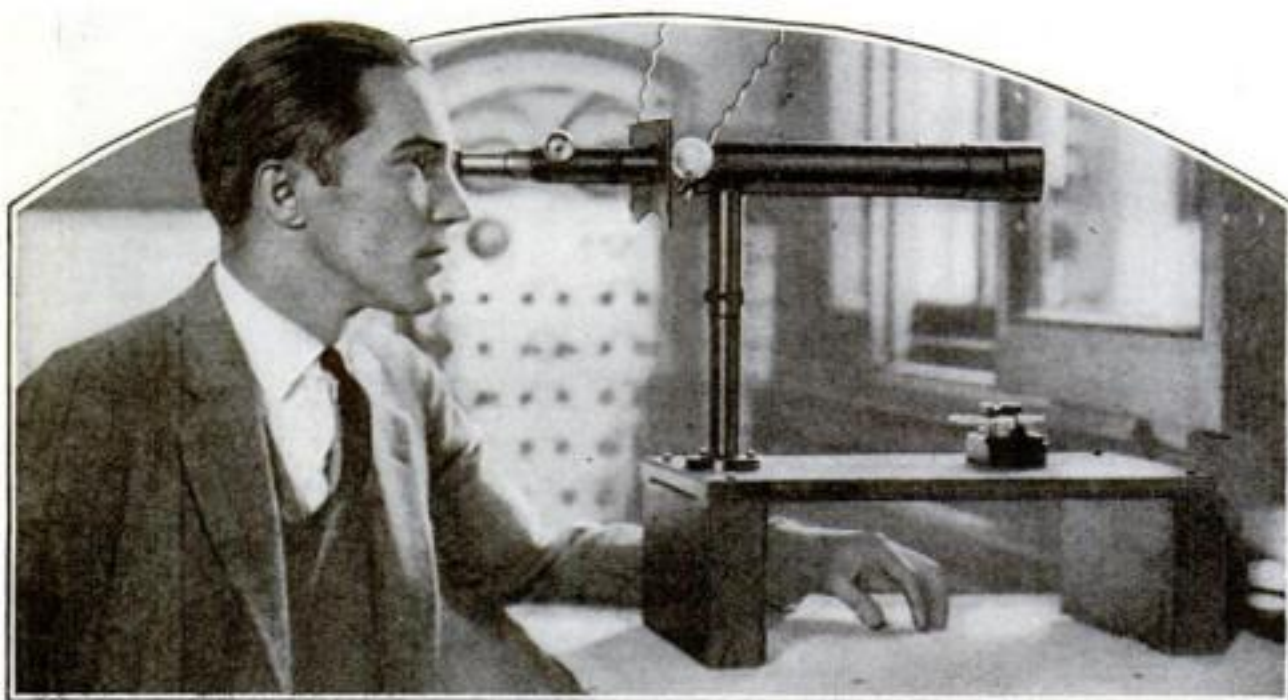
"If this famous spectacle weren't planned as carefully as a huge stage setting, under unified control, then it would soon run all together in a meaningless jumble of lights.

"Strict building and fire laws govern the erection of these signs. They have to stand high on stilts above the roof, so firemen can walk about underneath them in case of emergency. The steel supports are sunk in concrete and hooked up with the structural steel of the building. In one case they couldn't join the sign with the steel supports of the building, and they had to carry its legs all the way down through the walls to the ground.

"The roof signs have to be open skeletons. The force of a gale like this, hitting a solid sign, might rip the whole shebang loose and send it crashing down onto the crowd below."

From what George said, I learned for the first time that the famous Broadway kaleidoscope is the creation of highly paid engineers and artists, who consider Broadway their own stage and the night sky a backdrop for them

New Links in the Ever-Growing



An Instrument for Taking a Census of the Blood

This ingenious new instrument, known as an "interference apparatus," was invented recently by C. G. Peters and B. L. Page of the U. S. Bureau of Standards. It is used to check the glass plates employed by physicians to count the number of corpuscles in a cubic centimeter of blood. The new apparatus, according to the inventor, will give accurate calculations that are infinitesimal—as little as two-tenths of a micron. A micron is one-millionth of a meter.

To help you keep pace with the march of science, POPULAR SCIENCE MONTHLY presents here, in concise form, a number of the outstanding discoveries and achievements of the month.

Has the Glass House Come?

SHALL we all live in glass houses some day? Mr. G. A. Shieds, an Ohio inventor, claims to have found a way to make houses of glass, at a cost 20 per cent less than that of frame ones.

No paint, no plaster, no wallpaper. Soap and water would keep them clean and sanitary. For privacy's sake the glass is opaque and can be made in any color.

Mr. Shieds' invention is a machine that makes glass slabs three-eighths of an inch thick, 30 inches wide, and up to nine feet long. These are bolted to concrete foundations and screwed to a framework of wood.

Doctor Drinks Deadly Parasites

A HERO of science who came very near being a martyr is Dr. C. H. Barlow, a medical missionary in China. For the last 15 years he has been fighting a disease there, called "fascio-lopsiasis," which has taken millions of victims. This disease, which distends the abdomen, is caused by a flat parasite that sometimes grows more than an inch long.

To find out effects of the parasite, about three years ago, Doctor Barlow swallowed 132 cysts containing undeveloped parasites. He was deathly ill for four months, but finally recovered.

Recently he decided that his own laboratory was too small for further research, and that he must take some live parasites to America for study. How to get them there was the problem. Then this brave scientist did a heroic thing. Taking 32 live flukes from the body of a patient, he put them in distilled water and drank them. Only when he reached the end of his long ocean journey did he tell any one what he had done.

Soap a Germ Killer

A CHEMIST, during the Great War, observed that large quantities of fat from the soldiers' dinner table found its way into the garbage and was disposed of accordingly. He decided that the fat was much too valuable to be thrown away and persuaded the authorities to establish a factory near Paris, where the waste fat was boiled with lye, which yielded soap and glycerine. The soap was sent to the trenches, and the glycerine was shipped to the nearest munitions factory, where it was converted into nitroglycerine, one of several powerful explosives.

Recently Dr. J. E. Walker, a New York physician, called attention to some new properties of soap. In removing dirt from the skin, soap also removes bacteria, which are apt to be found among the

Cheaper Houses Made of Glass—New Sources of Rubber—Some Other Useful Discoveries

"dirt" particles. Doctor Walker, as a result of his experiments, says that soap not only removes dirt and bacteria mechanically, but actually kills many of the latter, in much the same way that carbolic acid does, except that the soap is not so powerful in this respect as is the carbolic acid.

We are told that any ordinary soap is active enough to remove germs, so that in the process of a thorough washing of the hands with the formation of a good lather, a highly appreciable proportion of the bacteria that may be present are killed. Here is an additional reason for using plenty of soap.

Sugar from Artichokes

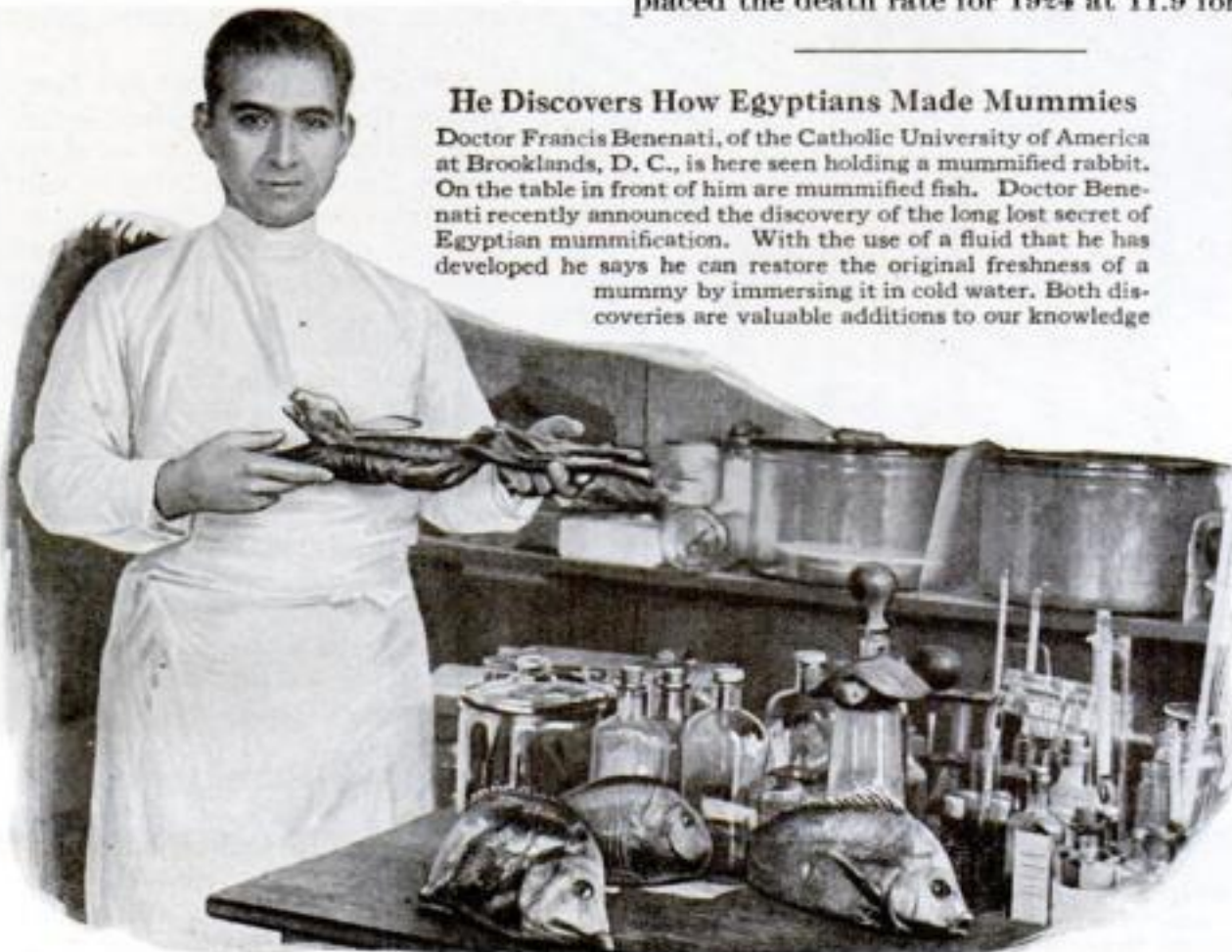
THE U. S. Bureau of Standards has found a way to get sugar from the Jerusalem artichoke and is now working to find how to produce it cheaply. The artichoke will grow anywhere in the United States, requires little care, and the tubers, from which the sugar is obtained, can be left in the ground over winter.

U. S. Death Rate Lower

THANKS largely to conquests made by medical science, the total death rate in the United States is decreasing, according to figures made public recently by the Department of Commerce. These placed the death rate for 1924 at 11.9 for

He Discovers How Egyptians Made Mummies

Doctor Francis Benenati, of the Catholic University of America at Brooklands, D. C., is here seen holding a mummified rabbit. On the table in front of him are mummified fish. Doctor Benenati recently announced the discovery of the long lost secret of Egyptian mummification. With the use of a fluid that he has developed he says he can restore the original freshness of a mummy by immersing it in cold water. Both discoveries are valuable additions to our knowledge.



Girdle of Science

1000 population, as compared with 12.3 in 1923. The number of deaths in 1924 among 99,030,494 people, or about 88 per cent of the population, was 1,173,990.

Automobiles are taking an increasingly heavy toll. Returns from 78 cities of more than 100,000 population each placed the daily average of automobile fatalities last year at 14.7, compared with 14.5 for the same period the year before.

The chief cause of death in 1924 was heart disease, which killed 176,671 persons, a slight increase over the preceding year. Deaths from cancer increased, the total being 91,941. Fatalities from tuberculosis decreased, the number being 89,724 in 1924, compared with 90,732 in 1923.

Synthetic Rubber in Sight

THERE is plenty of natural rubber still to be had, but we are using it up so fast that the end soon will be reached. In one year we require 350,000 tons of rubber for automobiles alone.

Science sees another way out of this dilemma. There are ways of making rubber synthetically. Out of petroleum you can get a substance, butadiene, which is the starting point for the manufacture of rubber. The Germans did something along this line during the war when they were hard pressed and found it impossible to import rubber. Today not only are German chemists hard at work on the problem, but so are American chemists. Both these groups can make rubber of a kind; but the more pressing problem is to make it cheap, so that it may become a commercial success. It is fairly safe to make the prediction that the chemists will win in the end.

Monoxide Gas Detector

The U. S. Bureau of Mines has perfected a device to detect the slightest quantity of carbon monoxide in tunnels and mines. In the picture below Miss Agnes O'Laughlin is using the apparatus to prove that though cigarettes contain this poison, it is not enough to be really harmful.



Tear Gas Guns

The men in the above illustration are examining a tear gas gun. They are three members of a party of explorers who are about to invade Dutch New Guinea. They will use tear gas guns as weapons of defense instead of revolvers if attacked.

Another Chemical Victory

WHEN a couple of chemists some years ago showed the world how they could make indigo, their discovery ruined the natural indigo industry in India. Chemistry produces synthetic indigo more cheaply than the Indian can grow the indigo plant.

Some such change is going on in the hardwood industry today. If you take hard wood and distill it, you get such valuable industrial products as acetone, acetic acid, and wood alcohol, besides the wood charcoal that is left in the still.

Now we have recently learned how to make acetone and acetic acid by a fermentation process, and more recently a commercial method for making wood alcohol from its elements has been developed. Already the hardwood people are fighting for their lives, for the fermentation and synthetic processes are getting cheaper daily. Fortunately, many of the hardwood distillers are cooperating with the synthetic chemists. Eventually the hardwood industry, like the natural indigo industry, must go to the wall, but there will arise a better and greater industry to take its place.

Aerial Night Photography

IN the dense blackness of night, a Martin bombing plane recently hovered over Rochester, N. Y., 3000 feet in the air. Suddenly a flash appeared in the sky. There was a tremendous rumbling, and many windows broke from the vibration.

In the bomber the shutters of seven cameras clicked, and a motion-picture camera took advantage of the brief glare. When the pictures were developed it was found that this experiment in aerial photography at night was a complete success.

Army officials point out that taking pictures at night would be of invaluable help in time of warfare.

Through the Tail of a Comet

WHAT if some day the earth should bump into a comet's tail? What would happen? Well, you ought to know. For just the other day you whizzed through the tail of Biela's comet.

Compared with the earth, a comet is a porous thing, made of rocks and gases hanging loosely together. The only thing unusual as we shot through the tail was a shower of meteors that burned up like sparks from Roman candles far in our upper air.

Biela's comet was first observed in 1826. Whizzing through space, it was seized by the gravity of Jupiter. But this greedy planet, which has reached its tremendous size through just such stunts, didn't succeed in grabbing it for good. It did affect it, though, so that it had to start on a regular pathway around the sun. That is why we can see it at regular periods.

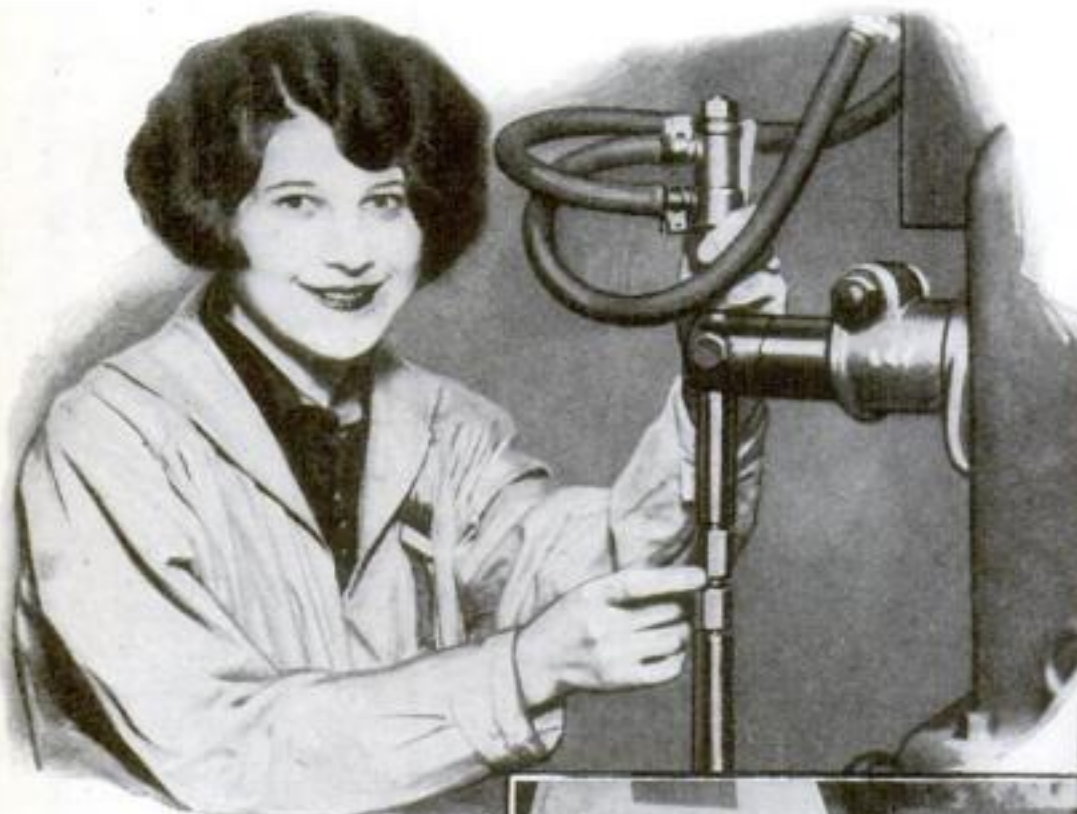
Every once in a while new comets are discovered. Two were found recently by American astronomers, Leslie C. Peltier of Delphos, Ohio, and Prof. George Van Biesbroeck of the Yerkes Observatory.



New Type of Muffler

Eugene Royer, of Paris, has invented a muffler for automobiles which, he claims, destroys, through a heating element, all smoke and the poisonous carbon monoxide gas that is a menace to city dwellers and to anyone working in a badly ventilated garage.

Women Who Hold Men's Jobs



Expert Woman Welder

Mrs. Martha Hoffman Henke of Chicago, one of the very few women welders in the world, explaining the art of welding. A short time ago in Boston she gave a demonstration of her mechanical art for the American Welding Society and the students of the Massachusetts Institute of Technology

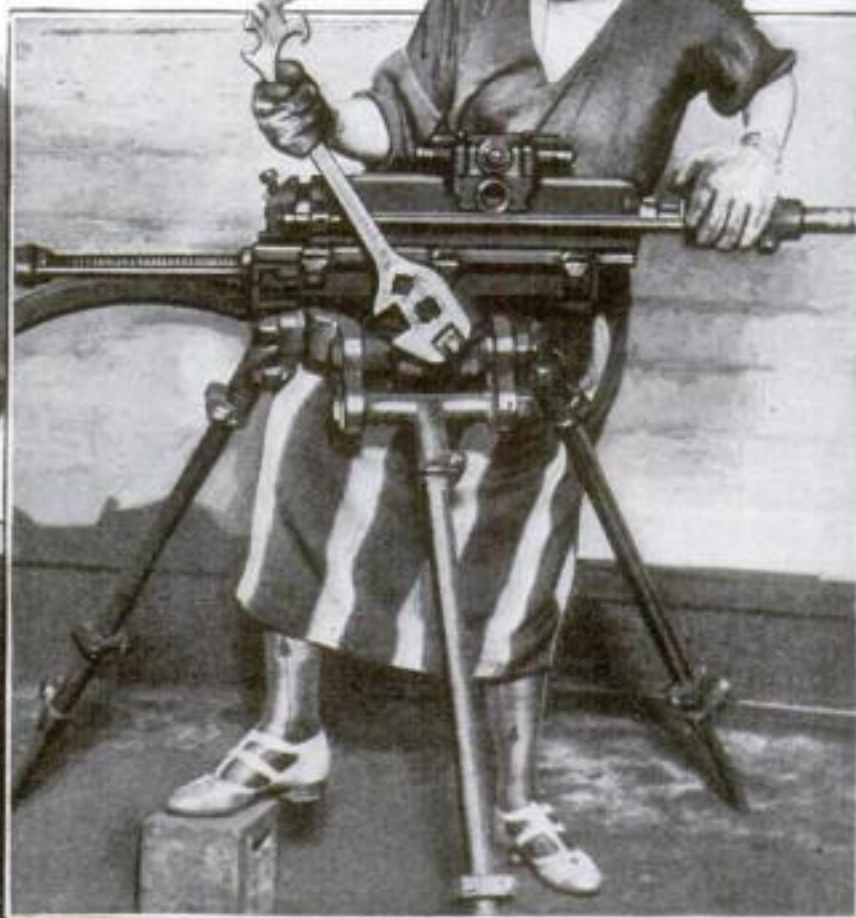


Behold "Mrs. Hercules!"

This is Mrs. Angelina Francesca, of Boston, carrying a big barrel. She is six feet six inches in height, and for 10 years she has been handling barrels and hogsheads at a barrel plant where she is employed. She, without a doubt, is the Amazon of New England

She Follows Mining

Miss Helen Antonkova overhauling a mining drill. Born in Siberia, she is now a student of mining engineering at the University of Washington



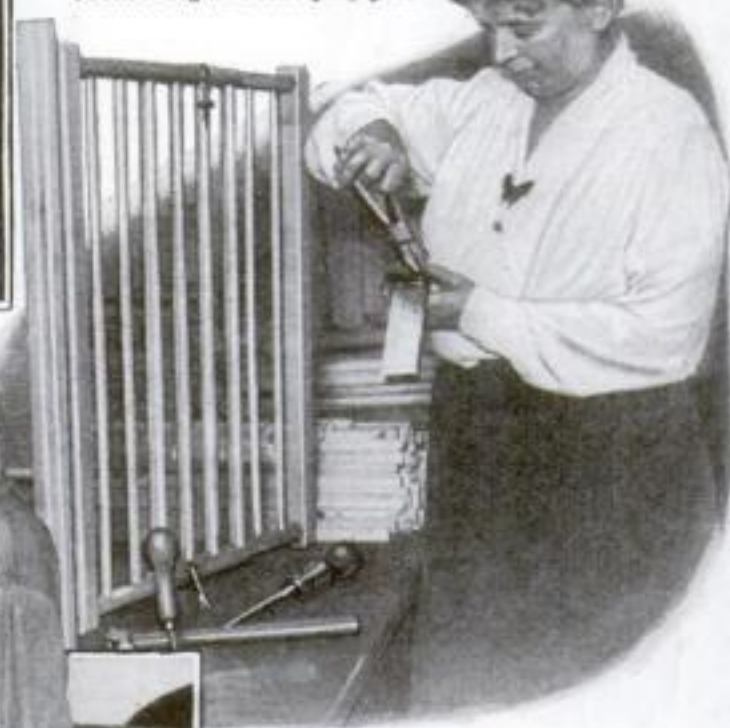
With Synthetic Sunshine

Doctor Rosalind Wulzen, of the University of California, is shown above experimenting with synthetic sunbeams. She uses a "sunshine" machine in her search for a cure for various ills now deemed almost incurable



A Worker in Wood

Mrs. Park of Garrard's Cross, England, making fittings for her invention—a portable telescopic nursery gate. This British matron knows tools as well as babies, and she keeps a workshop in her home. Her nursery gate placed across the nursery door makes of the room a big and safe play pen



Mechanics her Choice

Miss Thelma Holliday repairing the distributor of an automobile engine. She holds a regular job in a garage in New York City. She always preferred a screwdriver to a typewriter, and today she is said to be a genuinely competent auto mechanic. She says she thoroughly enjoys her unusual vocation and sees no reason why a woman who is mechanically inclined should spend her days filing cards or adding figures

Seven Ways in Which Seven Men Defy Age

THE veteran sportsmen on this page prove that rational physical exercise is the real secret of how to be youthful in ripe old age. The human body wears out prematurely only when it is worked too hard or not hard enough.



His Daily Dip

Louis Marquit, 68, of Brighton Beach, N. Y., taking his daily bath in the ocean in December. No weather is too severe to stand between him and his daily plunge



Two Ancient Mariners

T. H. Simmons, 70, and L. S. King, 83, members of a Boston boat club, who rowed recently down the harbor to Boston Light, a distance of 11 miles



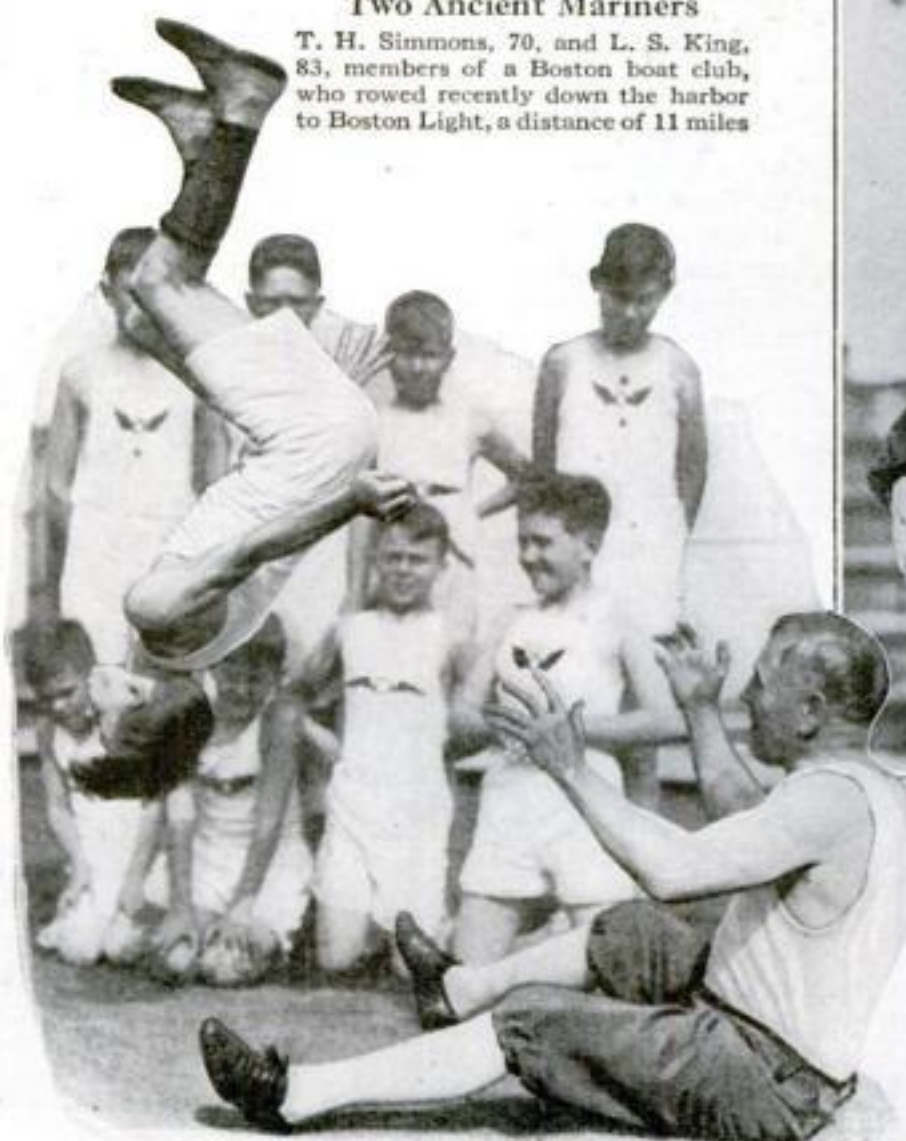
A Round a Day

John D. Rockefeller, Sr., 84, on links at Ormond Beach, Fla. He makes a round of the course once a day



Golf Does It

The New York banker and railroad executive, George F. Baker, now in his eighty-fifth year, keeps fit by playing golf. In the above picture Mr. Baker can be seen as he appears on the links at Asheville, N. C.



Age No Drawback

At 65, Robert Leando, of the Olympic Club in San Francisco, is putting through their gymnastic paces the grandsons of his first pupils. He is still an active athlete



Hunter at 90

Abraham Furst, 90, is the dean of Cincinnati huntsmen. For 73 consecutive years he has taken out a hunter's license in Ohio. Today his favorite sport is rabbit hunting

Famous Train Installs an Electrical Kitchen

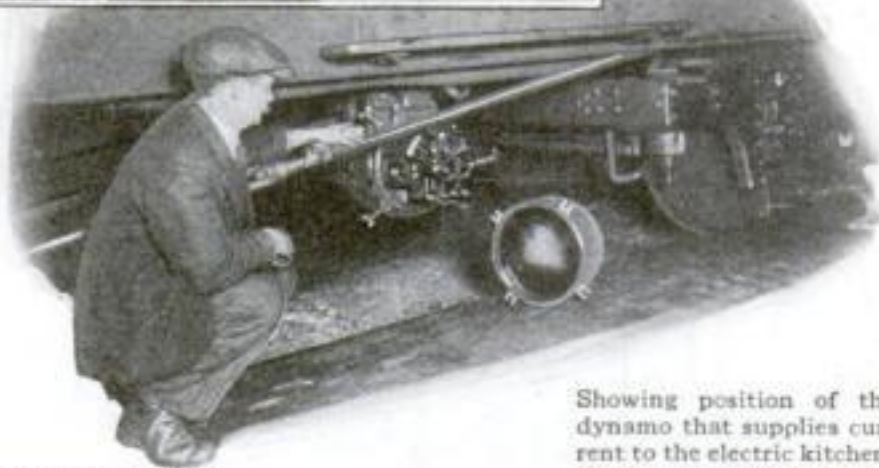


Compact and Clear

A railroad of Great Britain recently installed a complete electrical kitchen on one of its finest trains. At the left is shown the complete installation, with the chef, who merely presses a button when he wants to cook and now can keep his domain clean

THE *Flying Scotsman*, a train that runs between London and Edinburgh, has recently installed a complete electrical kitchen in its diner. The electricity is supplied by means of a dynamo run by the motion of the train.

Cooking by pressing buttons enables the kitchen to occupy the minimum of space, which obviously is of great importance in diner construction. All temperatures can be regulated exactly and the kitchen kept spotlessly clean. Like many a house-



Showing position of the dynamo that supplies current to the electric kitchen. The train's motion runs it

wife, the chef on this famous train is now a firm believer in the merits of "cooking by wire."

A Lamp that Casts No Shadow Has Many Uses



HERE is something that would fit right in a hair raising, nerve thrilling mystery story—a light that casts no shadow. In the photograph you see that though the woman's hands are clearly between the light and the table, there is no trace of a shadow.

Getting rid of shadow is of immense value for surgical operations, laboratory work, engraving, and other work where close application is necessary. A high power lamp is fitted in the center of an inverted flat bowl of sheet metal lined with silvered reflectors. Around the

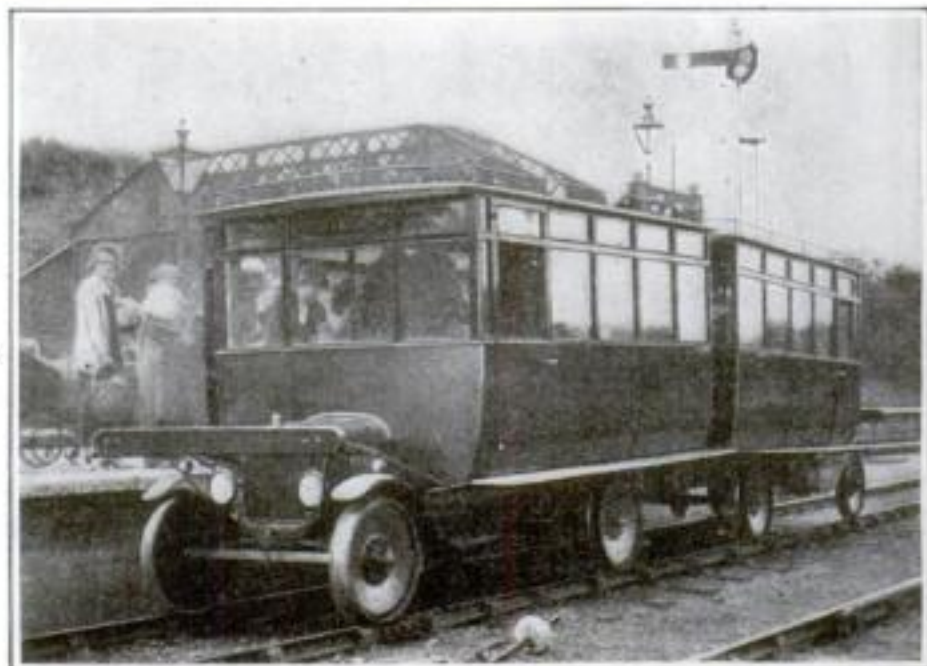
lamp is a cylindrical prismatic lens that deflects rays of light onto the reflectors on the edge of the shade, where they are thrown down in a circle of highly concentrated light. The diameter of this circle can be varied. A special glass cover on the lamp keeps heat from striking the operator.

"WOOD PUSSIES," once looked down upon because of the unpleasant reception they give unwelcome intruders, are now being regarded more highly. Next to muskrats, skunks are the most important fur-bearing animals in the United States. Thirty-four states protect them by law.

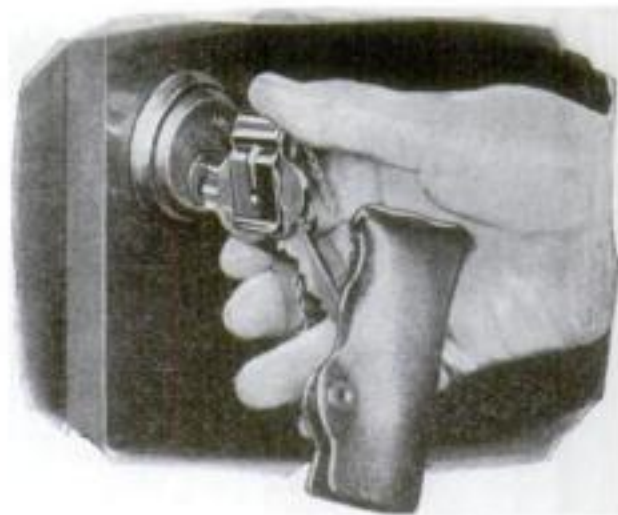
Runs Motor Bus on Rails for Greater Speed

ECONOMY for the railway company and comfort for the passengers are assured in this motor bus and trailer operated on a railway track in England. The only way in which the vehicle differs from a bus traveling on the highway is that its inflated tires have been replaced with flanged wheels.

Greater speed and also less consumption of fuel are two big advantages claimed for it.



Motor bus and trailer operated on railway track



Novel Type of Key Holder Is Handy in Use

IF YOU ever have stood in a dark hall, trying to disengage your key from its entanglement with the other keys in your ring, you know how trying is the habit of keys with the ordinary ring. Here is a new type of key holder, in which the key swings out like the blade of a knife. This new device, it is claimed, makes each key quickly available and eliminates the necessity of handling the whole bunch of keys in order to find the one you want. This new holder carries the keys flat, and it is provided with a leather case to protect your pocket or the lining of your bag.

The Human Voice to Control Electrical Current?

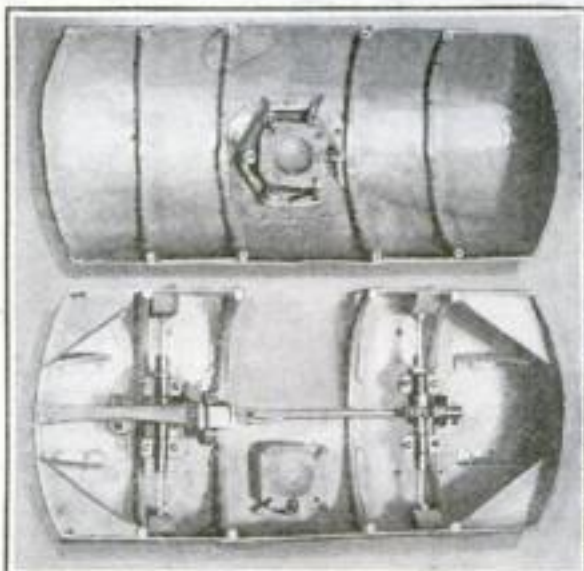
AN ENGINEER of Nottingham, England, claims to have discovered an invention that controls electric current by speech. It is possible by this invention, it is said, to stop and release current. The sound waves of the voice are transformed in such a way that they will control any electrical circuit.

THROUGH a mechanical error which resulted in the omission of several words, an item published in our January issue stated that Charles Hoff, world's record holder in the pole vault, is a native of Denmark. As a matter of fact, Hoff is a Norwegian. His record vault, however, was made in Denmark, and this is the information which the article was intended to have conveyed.

He Says His Lifeboat Prevents Submarine Fatalities

A RESIDENT of San Francisco, Daniel J. Carr, has invented a lifeboat to be carried in submarines. It is a cylindrical steel compartment that would be accommodated in the superstructure of the sub's walking deck. The floor door is fastened in such a manner that in an emergency it could be released readily, when the boat would float to the top of the sea by reason of its own buoyancy.

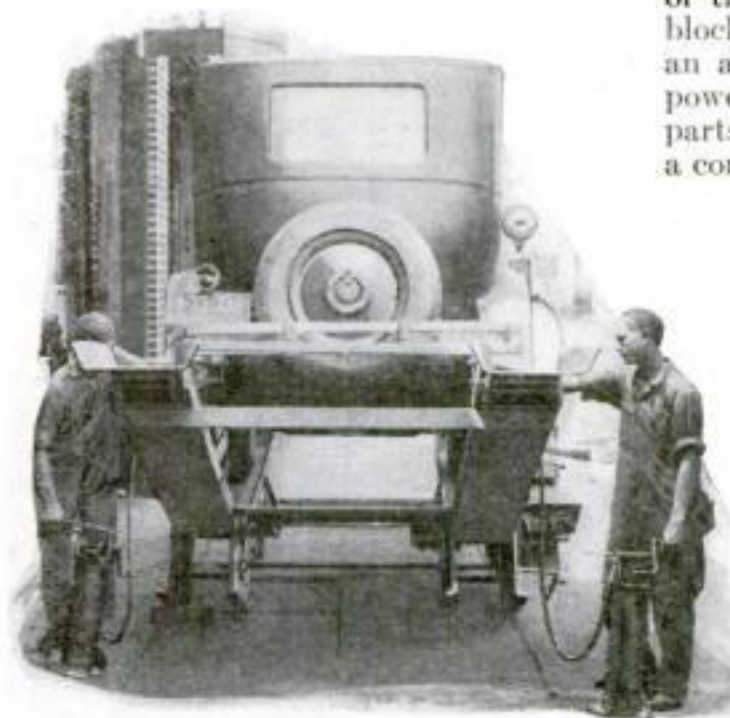
Once the boat reached the surface, it could be fully opened and an SOS sent out by a small wireless set.



Three views of Daniel J. Carr's submarine lifeboat and the inventor holding a model of it



Mechanical Rack Raises Car Easily to Working Height



The rack, which requires no installation work or pits, is placed on the level, and the car is driven on it. The rear wheels of the car are held in position by steel blocks, and the car is tilted and held at an angle of 40 degrees by a one-horsepower motor. Now you can get at all parts comfortably, for the car is held at a convenient working height.

New Plane Designed to Climb Nine Miles

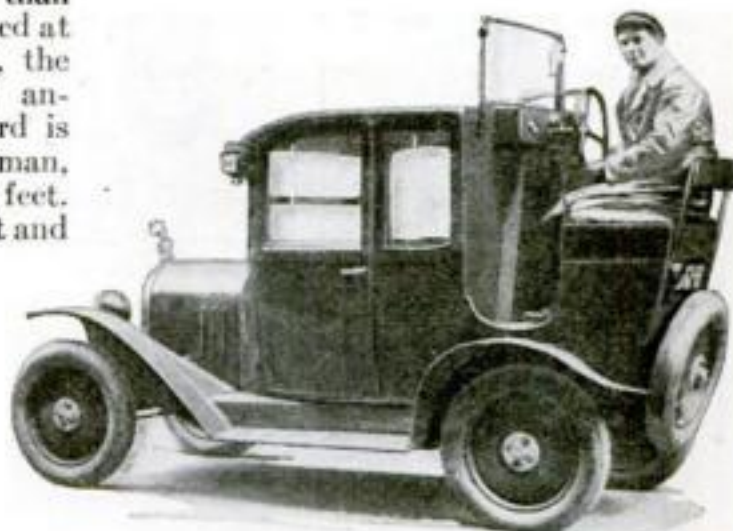
TO RAISE still further what aviators call "the ceiling" of the sky, a remarkable new type of airplane designed to climb an altitude of 50,000 feet, or more than nine miles, is being constructed at McCook Field, Dayton, O., the War Department recently announced. The present record is held by M. Callizo, a Frenchman, reaching a height of 39,586 feet.

Wings of extraordinary lift and a propeller of unusual diameter are being installed in the new plane to provide increased lifting power in the rarified upper atmosphere. The wings, of wood and fabric, will have an area of 600 square feet. A 400 horsepower engine drives the machine.

Motorized Hansom Cab Is Now Popular in Paris

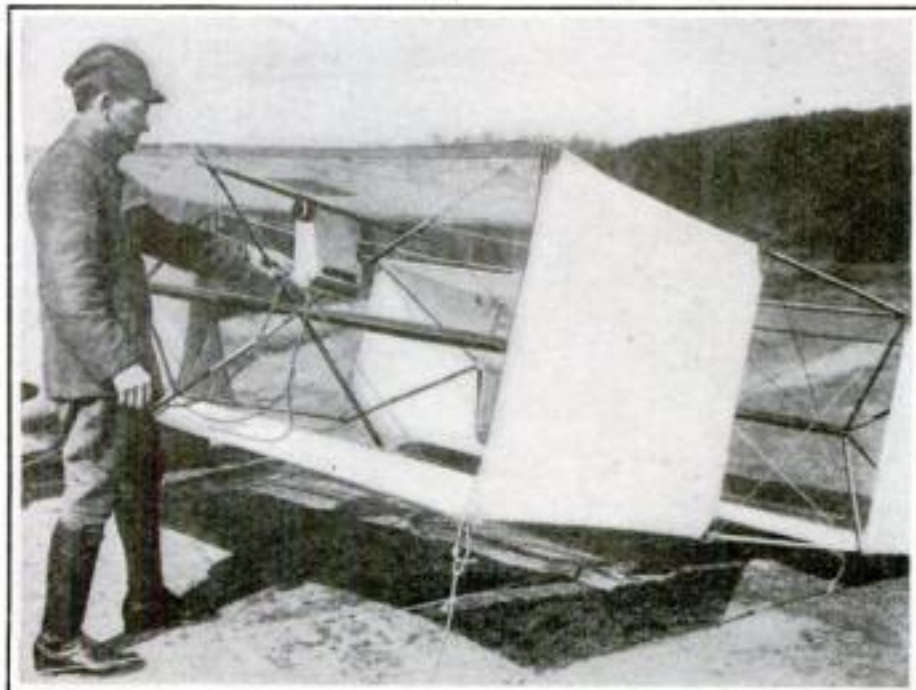
ANY elegant old gentleman about town, in London or New York, will tell you of the comfort of the hansom cab, and the delight of driving in one, with doors wide open, down Pall Mall or Fifth Avenue, on a sunny day in spring. Perhaps we soon shall have an opportunity to test the truth of his tale. There recently appeared on the streets of Paris a new type of taxicab that caused a sensation, but at once became popular—the "motorized hansom cab."

The new taxi borrowed the idea for the driver's seat from the hansom cab and placed it high at the rear of the vehicle.



IF YOU ever have had occasion to get under your car, without the assistance of a mechanical device to raise or tip it, you will appreciate a recently invented rack, mechanically operated, which is at once a tipping, conveying, and service device. The rack will accommodate itself to any make of car.

New Kite Inspired by Flettner's Rotor Ship



The rotor kite, recently flown in Germany

SINCE the time Flettner's first ship skimmed over the water propelled by a huge rotating cylinder, last year, inventors have been working on adaptations of this new way of propelling craft. In the photograph is seen a rotor kite flown at a recent aerial jubilee at Lindenberg, Germany.

The kite is sailed on exactly the same principle as the ship, wind striking a rotating cylinder, creating force and suction.

The occupants of the cab thus are afforded a clear view of the road in front of them and business men need not fear that their grave trade secrets will be overheard by the driver. The drivers also can better survey the street ahead.

Devices Invented for Raising Sunken Submarines

RECENTLY news came from Tokio that a Japanese had invented an entirely new device for raising sunken submarines. Almost simultaneously with that news comes word that Dr. J. Townsend Parr, of Oakland, Calif., had perfected an invention to bring sunken ships to the surface without the aid of divers. Patents have already been taken out and on advice of the naval authorities the plans have been sent to Washington for the perusal of submarine experts and naval heads.

The Most Thrilling

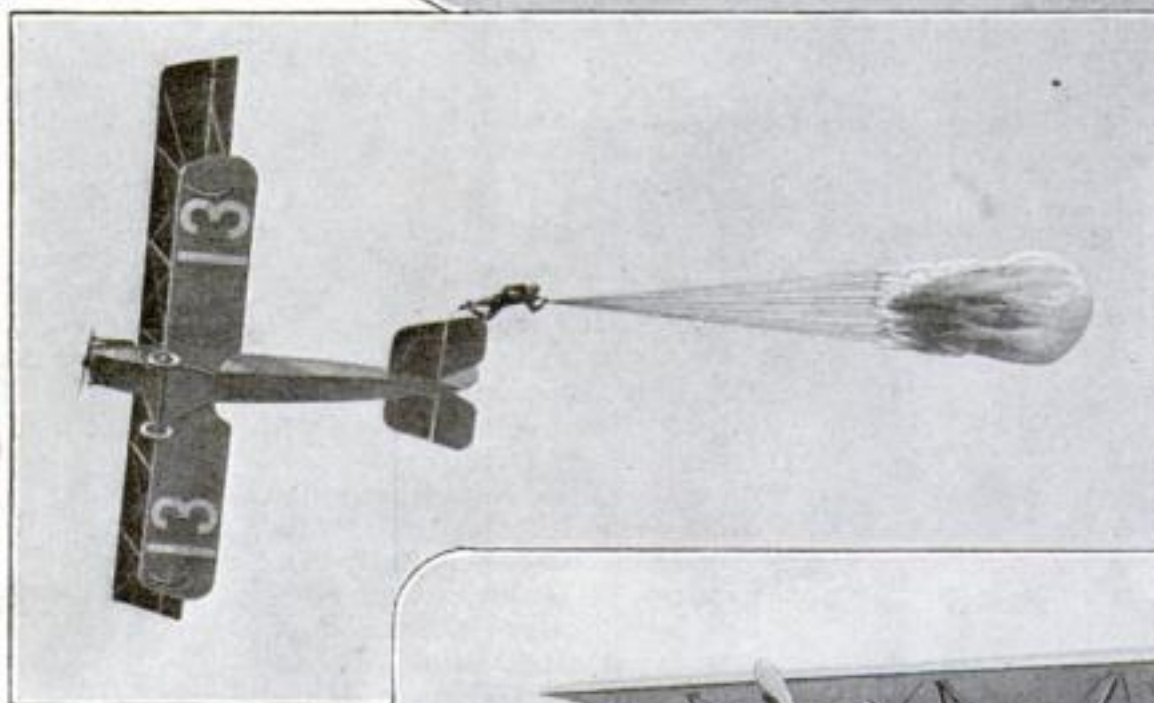


He Built His Own

Not satisfied with the distinction of being the youngest steamboat captain in Baltimore, Md., Walter Novak also wanted to fly. He bought scrapped parts of dismantled planes and fashioned the smart air flivver shown above

A Lucky 13

Number 13 was no hoodoo for Al Johnson when he jumped from a speeding plane only 150 feet from the ground. The opening parachute jerked him free and landed him safely. At right: How the spectacular feat looked to those below

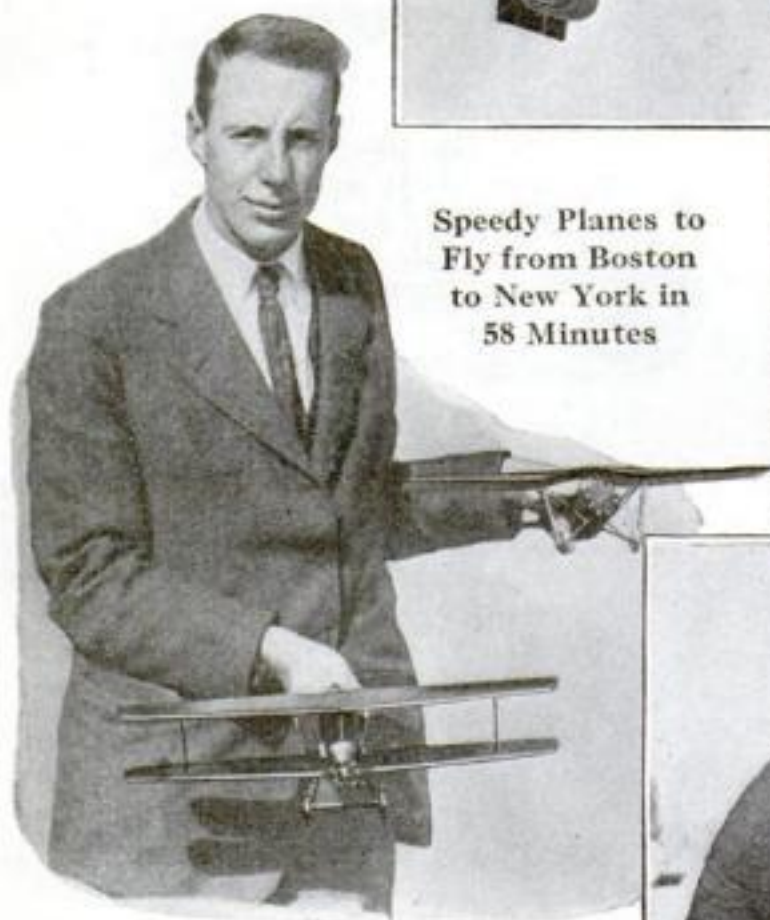


Charleston in the Air

Above: "Spider" Matlock, Al Johnson, and "Fronty" Nichols of the famous "Black Cats," the 13 professional daredevils of the Los Angeles moving-picture colony, who perform virtually all of the thrilling aerial stunts you see on the screen. Here they are doing the Charleston on the wings of a plane speeding 80 miles an hour a half-mile in the air



Speedy Planes to Fly from Boston to New York in 58 Minutes



Above is F. T. Kurt, of the Aeronautical Engineering Society of Boston, with models of two new types of airplanes designed for regular passenger and express service between Boston and New York. He declares the machines, when completed, will be able to cover nearly 200 miles between the two cities in 58 minutes. The models, each of which was made at a cost of \$700, are being subjected to exhaustive tests at the Massachusetts Institute of Technology



Paris to New York

Above is the Potez biplane in which the French aviators, Coli and Tarascon, will attempt a non-stop flight from Paris to New York, competing for the \$25,000 prize offered by Raymond Orteig of New York City

New Type Airship

For five years Thomas B. Slate, of Glendale, Calif., has been working on an idea for a new type of commercial airship. At left he is seen with his model explaining operation of a novel propeller

Game in the World



"Changing Cars" in the air

Catching the morning train on the run would be no feat at all for Burt Koglo of Mason City, Iowa. He proved it recently at Clear Lake when he jumped from a motorboat traveling 60 miles an hour and caught a rope ladder lowered from an airplane doing 80 miles



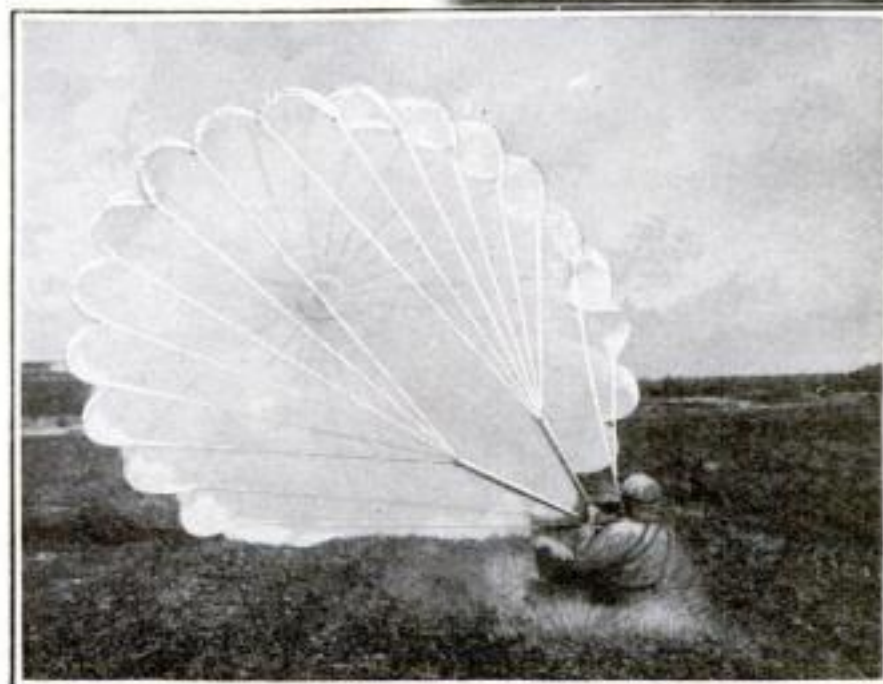
New Fog Signals

At the great Croyden Airdrome in England, the air port for cross-channel passenger planes, an elaborate new lighting system recently was installed to guide airmen to a safe landing in the fog. Electricians are seen above installing a series of fog-piercing flashlights for use in open trenches



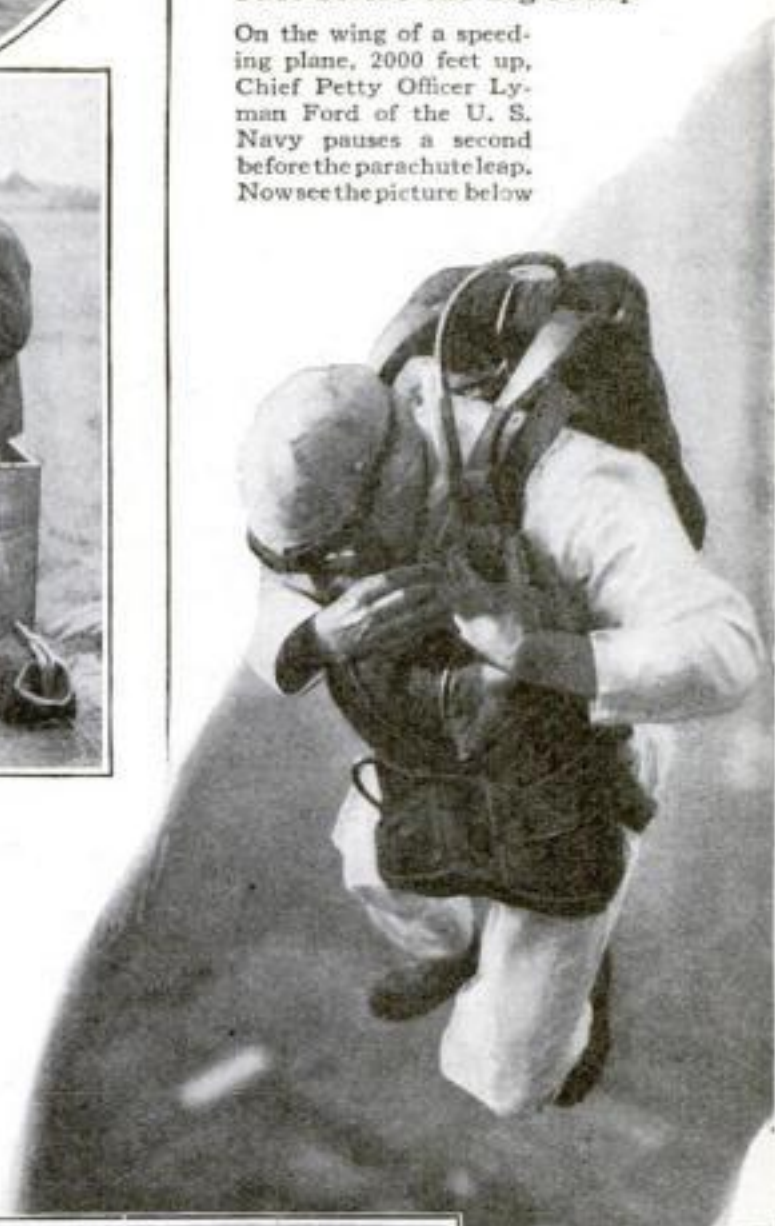
Air Gunnery in Japan

How a Japanese aviator trains his machine gun on a supposed enemy—the photograph shows planes "attacking" during recent air maneuvers in the neighborhood of Tokyo



Just before the Big Jump

On the wing of a speeding plane, 2000 feet up, Chief Petty Officer Lyman Ford of the U. S. Navy pauses a second before the parachute leap. Now see the picture below



Going Down!

Two seconds after the leap. Ford's hands are on the release that will open the parachute on his back. Next see

The Landing

Picking a soft spot to land on is not quite as easy as it looks. Notice how the open, air-filled parachute drags Ford over the ground

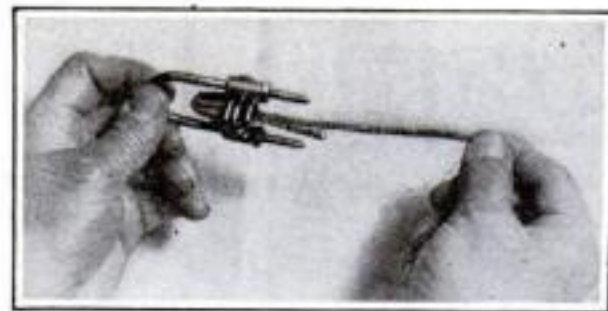
This Phone Meter Registers Length of Calls



IF YOU use your telephone very little, and Mrs. Jones down the line uses hers for 20-minute visits, then she ought to pay more for her service. So believes a California man who has devised a way to make her pay.

Frank S. Rich, of Los Angeles, invented this new meter device that registers calls by their length. It is worked by a mercury switch, operating on the principle of an hourglass.

The usual method of paying for the telephone by the number of calls, Mr. Rich protests, is like paying for water according to the number of faucets used. One faucet may run 10 times as much water as another. One telephone call may consume 30 minutes, another only 30 seconds. The picture to the left shows Mr. Rich and his invention.



Wire Clamp that Replaces 42 Other Devices

IF ALL that is claimed for it is true, this sturdy turnbuckle clamp must be worth its weight in gold. The maker declares that for fastening wire, whether to stretch it or for other purposes, the clamp does all that 42 other articles can do and he lists the 42 items which he thinks his clamp may replace.

It is useful as a ground-wire clamp also, giving a better electrical connection, as it brings the wire in direct contact with the pipe. The same is said to be true of the clamp if it is used in place of a standard feed cable tap.

First Electrically Driven Passenger Ship

WHEN the *Gripsholm* sailed up the Hudson River in New York recently, the huge motor-driven liner was the first of its kind seen in America. No smoke, no soot, for not a particle of steam is used on this Swedish ship, not even for heating or cooking.

Although it has no need for funnels, the *Gripsholm* carries two, just because we are used to seeing them on ships. One of the funnels is used for an elevator shaft and the other for ventilation and to carry off the motor exhaust.

The ship has six decks and accommodations for more than 1600 passengers. Two Diesel engines propel the liner. Compressed air pumps the crude oil used for fuel into the cylinders, where it explodes somewhat like gasoline does in an automobile engine.

Lighting, cooking, and heating all are done with electricity. Even the hoisting apparatus for baggage and freight is operated electrically.

A Lock Washer that Will Really Lock



A LOCK washer that really locks is the claim for this thin ring of highly hardened steel cut in the shape of a miniature gear. The teeth are set at a slight angle so that when pressed between a nut and a metal surface they dig into the softer metal. This is said to prevent vibration and keep the nut from working loose.

The new washers are made in all sizes and are suitable for all classes of machinery in the automotive industry, in railroad track work, and structural work. A close-up picture of the new lock washer is seen above.

The new washers are made in all sizes and are suitable for all classes of machinery in the automotive industry, in railroad track work, and structural work. A close-up picture of the new lock washer is seen above.



In the above illustration a workman is shown using this convenient drill to bore out a lead terminal on a storage battery

New One-Hand Drill

HERE is a light electric drill, weighing but 3½ pounds, that may be operated with only one hand, may be carried about easily, and can be handled for a long time without fatigue to the operator. The grip of the drill being on a direct line with the chuck gives a straight-line pressure on the drill bit, thus eliminating side strain.

The motor of the drill is ventilated thoroughly and cooled by air drawn through the handle and exhausting through portholes in front of the motor.

AT THE HAGUE, in Holland, a telephone subscriber can have radio also, for a unique installation has been made that enables telephone subscribers to get broadcast music over the wire by calling up a special radio number. The radio connection is broken off automatically if the subscriber's telephone number should happen to be called.

An Instrument to Test Solid Concrete

THE U. S. Bureau of Standards has developed an electrical device, called a "telemeter," to measure accurately the stresses and changes of pressure in a solid concrete structure. The telemeter consists of a stack of carbon disks, both ends of which are connected by electric wires with recording instruments. The electrical resistance of the carbon disks varies with the pressure put upon them.

A concrete dam, in course of construction in California, will be tested to the breaking point by the new device. While the liquid concrete is being poured, the carbon disks, placed in cartridges, will be inserted into it, and the necessary connecting wires will furnish a complete record of the increasing pressure and the resulting stresses.

Shoe-Polishing Outfit at the End of a Handle

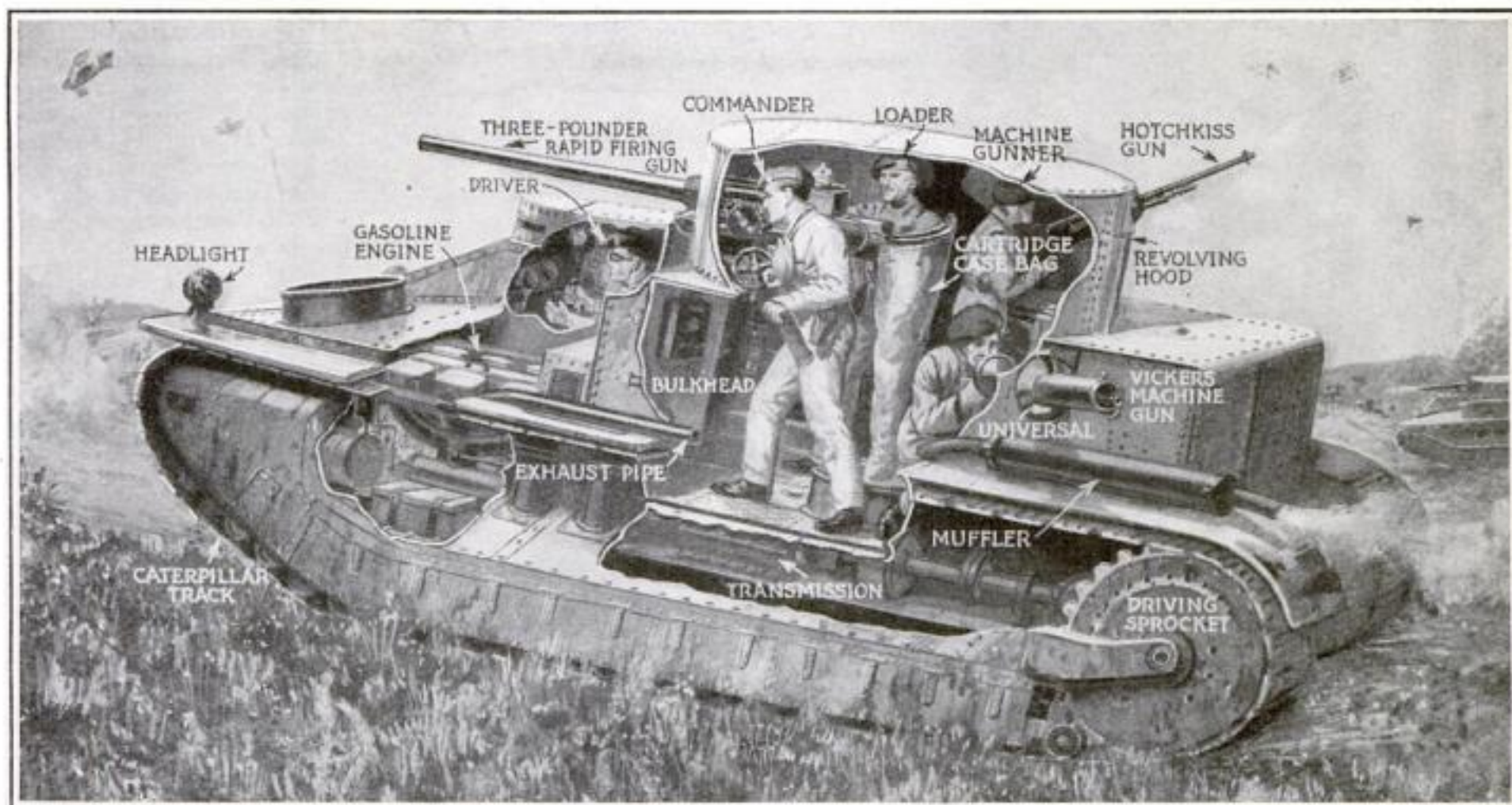
DAUBER, brush, and polisher all at the end of one handle—that's compactness. Stephen Murphy, of San Francisco, never could keep together all the things needed for polishing his shoes, so he used his inventiveness to figure out the handy combination illustrated.

The dauber for the shoe polish fits in between the brush and wool polisher. A push on a lever on the brush handle brings it out when needed.



The above device contains three articles in one—a shoe brush, a polisher, and a dauber

New Type of Armored War Tank Appears in England



THE light tank illustrated above is Britain's latest achievement in this type of war machine. It is 17 feet long and 8 feet 6 inches broad. A three-pounder quick-firing gun is the main

armament, with Hotchkiss and Vickers machine guns to back it.

Five men make up the crew—a driver, a loader, two men for the machine guns, one a reserve driver, and a gun layer for

the three-pounder, who is usually the commander. This tank can travel over plowed fields at a rate of 20 miles an hour—four times as fast as the old tanks first used during the war were able to go.

Carry Your Chair with You in a Cane

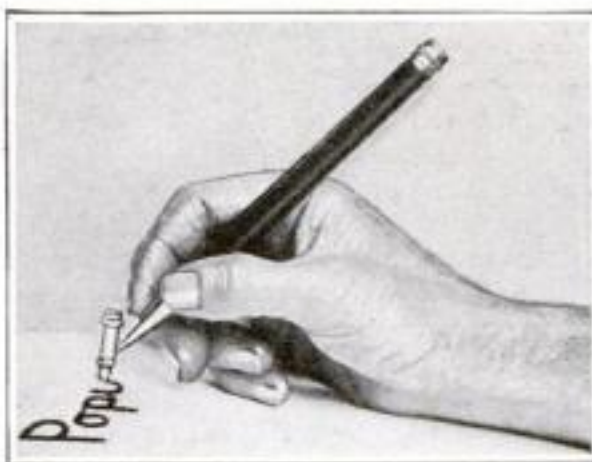


A CANE that also serves as a seat is a familiar sight in England, where spectators use them at polo meets, races, and on the moors in the shooting season, also on the sidelines at any outdoor sports, and between events. Now that it has reached the United States, we may find other uses for it.

Usually made of a light but sturdy wood, the crooked head of the walking stick opens in two parts that bend down in opposite directions to form a seat. Closed, it looks like an ordinary walking stick. A metal

disk that usually is fastened near the stick's handle, slips over the point at the bottom, holds fast, and keeps the stick from sinking too far in the ground.

THOUGH angleworms cannot distinguish objects, they are not blind. They have light-sensitive organs distributed along the whole length of their bodies that perform the function of the normal eye.



Fountain Pen Is Designed for Lettering

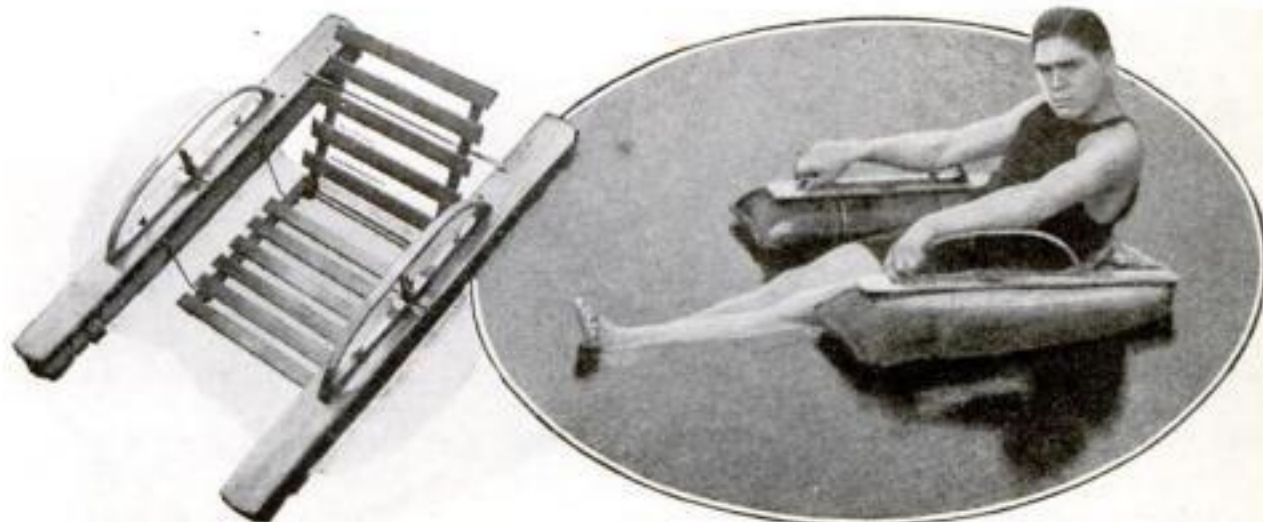
LETTERING can be done with the ease of writing, it is claimed, with a new fountain pen made specially for this work. There is a constant flow of ink automatically controlled by the pressure used in writing, and by it letters can be formed continuously, without having to patch them up later. The lettering is done with a rigid marking disk. An illustration of the new pen is seen at the left. The ink reservoir is toward the top.

A Collapsible Floating Chair for Bathers

THE inventor of this collapsible floating chair for bathers is Thomas La Farina. The bottom and back of the chair are made of slats. A piece of U-shaped rubber tubing is fitted between

two boards at each side. Curved pieces on top of the boards serve as handles.

When deflated, the tube can be rolled up, and the collapsible wooden parts can be carried in a small, compact package.



Above, at the left, is a plan view of the improved floating chair. At the right, the inventor is seen seated comfortably in his new creation, which is designed to bring joy to the sea bather

Ingenious Machine for Picking and Husking Corn Rapidly



This machine picks and husks seven acres of corn a day

OPERATING at three times the speed of a hand picker, a machine for picking and husking corn in the fields has been added to equipment designed to make farm work easier. It is hitched to a tractor and is run by power obtained from the tractor by means of a special power take-off attachment that works in soft ground where traction is poor.

Delmar Van Horn of Rippey, Ia., is shown in his machine, which is said to pick from five to seven acres of corn in a 10-hour day, thus saving time and labor.

High Altitudes Destroy Plane Power

TESTS made by the U. S. Bureau of Standards show that the engine power of a plane is reduced one-third when it rises to an altitude of 30,000 feet above sea level. Many experiments were made and they all demonstrate that the loss of power is caused by the steady drop of air pressure, as the machine ascends. An airplane motor in high flight may be compared to a mountain climber who invariably weakens at high levels.

Most people know that the flavor of apples improves with keeping. Recent research shows that this is due to the gradual reduction in the apple's acidity. This decreases at first rapidly, then more slowly. In apples kept in cold storage the loss of acidity is a much slower process. If an apple has too much acid when it is first put into cold storage, it is likely to decay.

Tree Seeds Threshed by Machinery

ON LANDS bared by forest fires, nature can't be depended upon to reproduce forests quickly enough. United States foresters must help by sowing tree seeds. But it takes 200,000 seeds of Western yellow pine to plant a single acre. Collecting all these and getting them ready for sowing is a real job.

In the photograph to the right is a threshing machine used to remove the wings from Western yellow pine seeds in order to reduce their bulk and make them easier to plant.

Out of 200,000 seeds, half may germinate, but only about a thousand seedlings reach a height of one foot, and of these probably only 30 will reach maturity.



Men in the photo above are threshing Western yellow pine seeds for forest planting

A NEW yarn, with the warm, soft feel of lamb's wool, now is being made from the waste product of the artificial silk industry. United States Department of Commerce officials hold out a great future for the new fabric, which already is being

manufactured in the United States as well as being imported from Italy, where it started. The new "wool" is shimmery and dyes in beautiful colors. Combined with real wool in making serge and other goods, it improves its appearance, as silk does.

An Orchard Device to Sort Fruit Mechanically

ANOTHER machine to save cost of labor. This mechanical fruit sorter, which can be carried out into the orchard and set up anywhere, is said to be much more rapid and efficient than the usual

hand methods. Oranges, apples, or other fruit are fed from a hopper to a wide perforated rubber belt. The undersize fruit falls through the perforations and is delivered to the side, while six spiral sorting rolls keep the fruit spinning slowly, as it passes forward down the table. The sorters pick up the culls and second-grade fruit, placing them on belts at each side. The first-grade fruit enters the middle bin.



Undersize Fruit Here

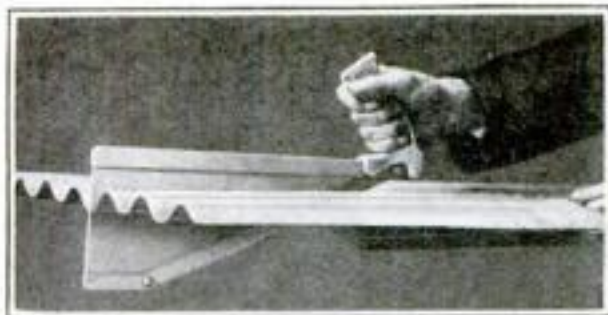
This new fruit sorter can be set up anywhere. The first-grade fruit, after mechanically revolving on the sorting table, passes unhandled into a bin

A New Fuel from Bark



PRESSED bark, mixed with wood waste, is a new fuel that can be used to replace some of the coal required by mill boilers. When 50 per cent of the moisture which the bark contains is removed, the bark is changed from cumbersome waste, which will not burn alone, into a low-grade fuel.

The bark is put into a special press. In this machine chunks of wood and the smaller splinters, such as are usually lost in the water in a paper mill, are handled along with the bark and used also. In the upper right corner, is shown a handful of the new fuel. In the left lower corner, a sample chunk of the unpressed bark.



A Convenient New Frame for Hacksaw Blades

THE above photo shows a convenient holder for hacksaw blades used in cutting corrugated iron and other sheet metals, asbestos sheets, ebonite, and various compositions, if set in this new saw frame, an English invention. The blade is set at an angle so that it will cut through any length or width of material.

It is used like a carpenter's hand saw, and will take care of jobs that ordinarily require a hammer and cold chisel, or a large pair of shears, and that frequently ruin the teeth of the usual hand or panel saw.

She Keeps Her Golf Score on Her Bracelet

CARRYING your golf score on a wrist-band is the latest innovation for the golf links that recently arrived here from England. The score for two players fits in a leather case strapped around the wrist.

The whole thing, including pencil, is little larger than a wrist watch and provides a convenient way to keep track of



Keeping score on bracelet card

the score. Mrs. Henry Graves of Chicago and Miss Edith Renanf of Boston are shown above making use of the score card wristlets for the first time.

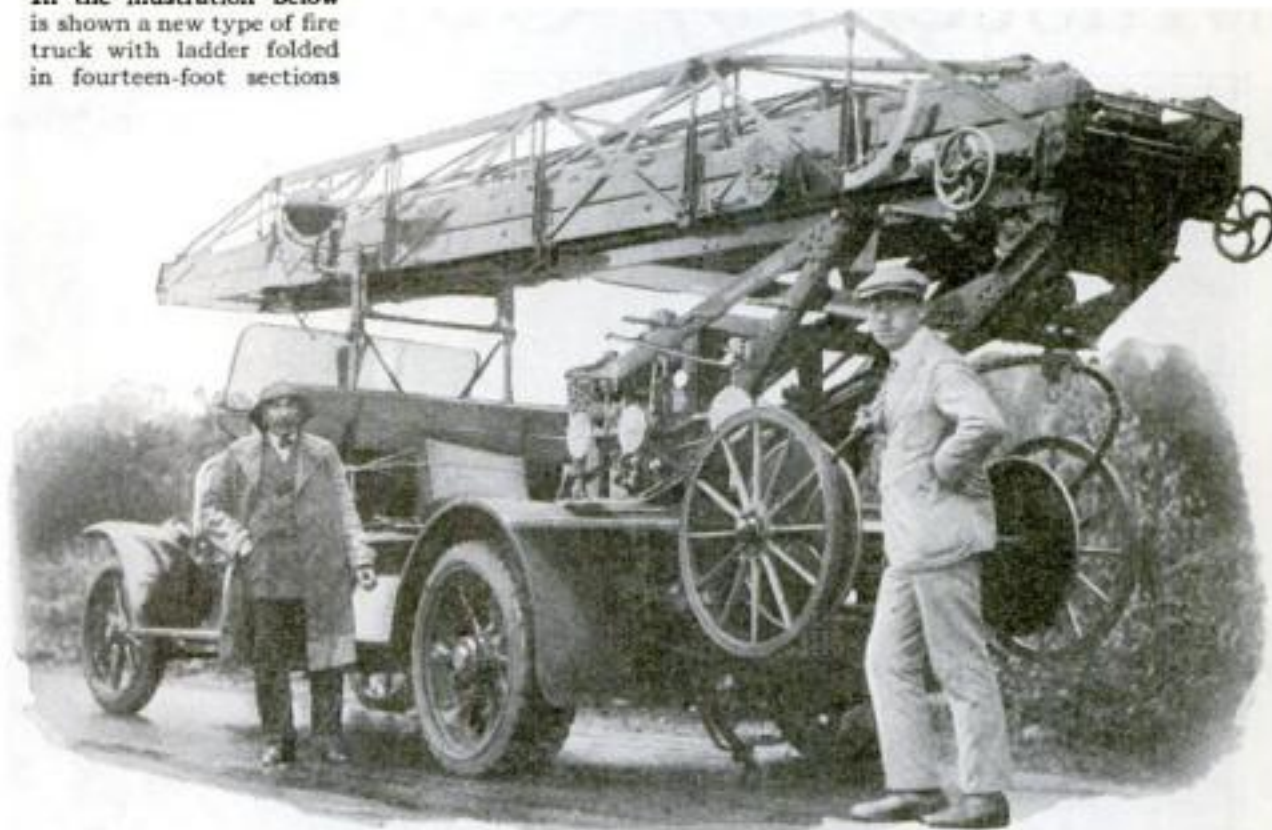
Pianos for the Tropics Must Fight Moisture

WHEN you think of what happens to your piano during damp weather, you can imagine what would happen to pianos in the tropics, with the long rainy seasons.

Pianos for the tropics are built especially to withstand moisture. No veneer can be used, only solid wood; all joints must be dovetailed together instead of using glue. The wood must be insect-proof, such as cedar, and the felt inside must be soaked in insect poison. All iron parts are varnished and steel strings gilded to prevent rust. And the key-covering must be moulded of celluloid in one piece.

A Fire Truck with Self Supporting Ladder

In the illustration below is shown a new type of fire truck with ladder folded in fourteen-foot sections



LOUISVILLE, Ky., recently acquired a new type of fire truck with ladder which is not supported against a burning building, but stands on its own base.

When extended to its full length the ladder is 85 feet high and can hold eight men with safety, it is claimed. When not

in use it is lowered to 14-foot sections that rest over the driver's seat. This unusual truck, which was designed in Germany, recently toured New England and was used in other localities during the National Fire Prevention Week ceremonies.

A MEMBER of the research staff of a large chemical laboratory in Long Island City, N. Y., Dr. G. O. Curme, Jr. claims he has discovered an anti-freeze compound for motor cars that meets the requirements of the U. S. Bureau of Standards. The new compound is ethylene glycol, which combines the valuable properties of alcohol and glycerine.

FOR EVERY two persons in the United States there is one cow. We have the second largest herd in the world. India has 140,000,000. We have 60,000,000 swine, four times as many as in any other country. Corned beef and cabbage may be cited as our favorite dish, but statistics show that we eat more pork in the United States than any other meat.

How Quickly Can a Trolley Car Stop?

AT A recent trial in a California city, a young woman was suing for injuries suffered in a streetcar accident. An ex-motorman testified that a car traveling 20 miles an hour could be stopped in a space of 30 feet. The young woman's counsel denied vehemently the ex-motorman's statement. Thereupon the judge and jury went to the scene of the accident and gave the ex-motorman a chance to demonstrate.

A special speedometer, consisting of a

wheel attached to the side of the car, was used in the test. Measurements showed that the best the driver could do, with the car going at 20 miles an hour, was to stop the car in a space of 114 feet.



Above, on the left: A judge and jury watching to see how fast a trolley can stop. Observe (on the right) the special speedometer used in the test—a wheel attached to the side of the car



Masters of Curious Jobs

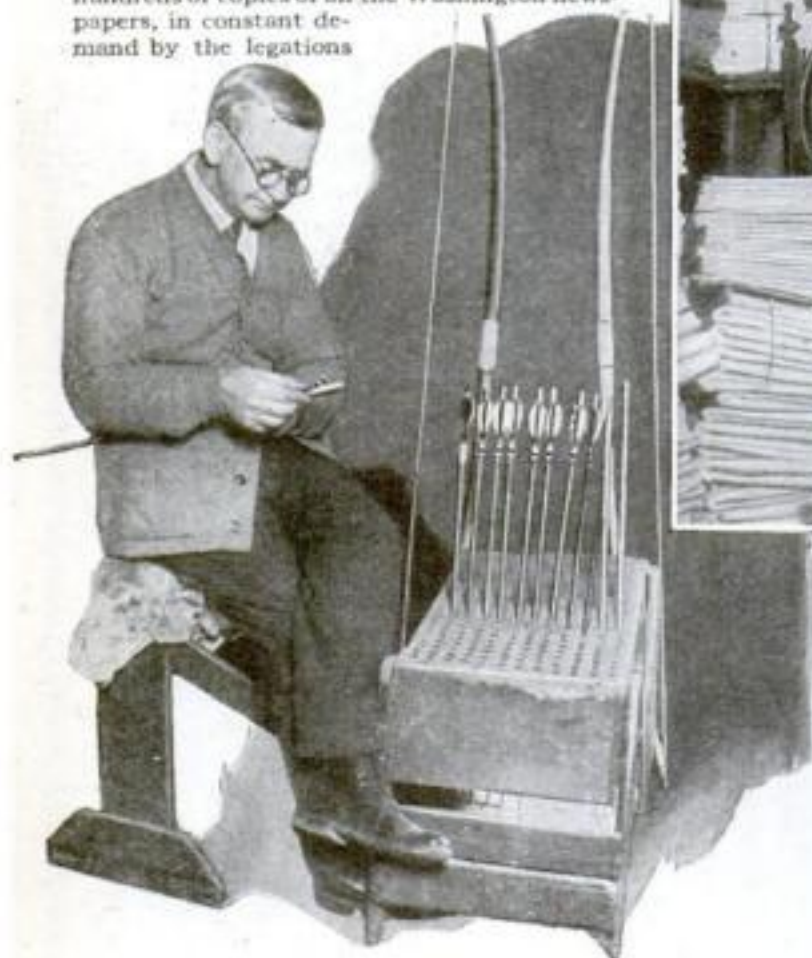


Maine's Champion Fiddler

The town of Norway, Me., headed by the Governor of the state, recently turned out to see the state's most celebrated fiddler, A. Mellie Dunham, 72, entrain for Dearborn, Mich., where he played his tunes for Henry Ford

A Dealer in "Antiques"

The picture to the right shows T. Sprole Leisenring of Washington, D. C., the founder and owner of the News Exchange, which he has housed in an old building, formerly a stable. Here he keeps carefully wrapped hundreds of copies of all the Washington newspapers, in constant demand by the legations



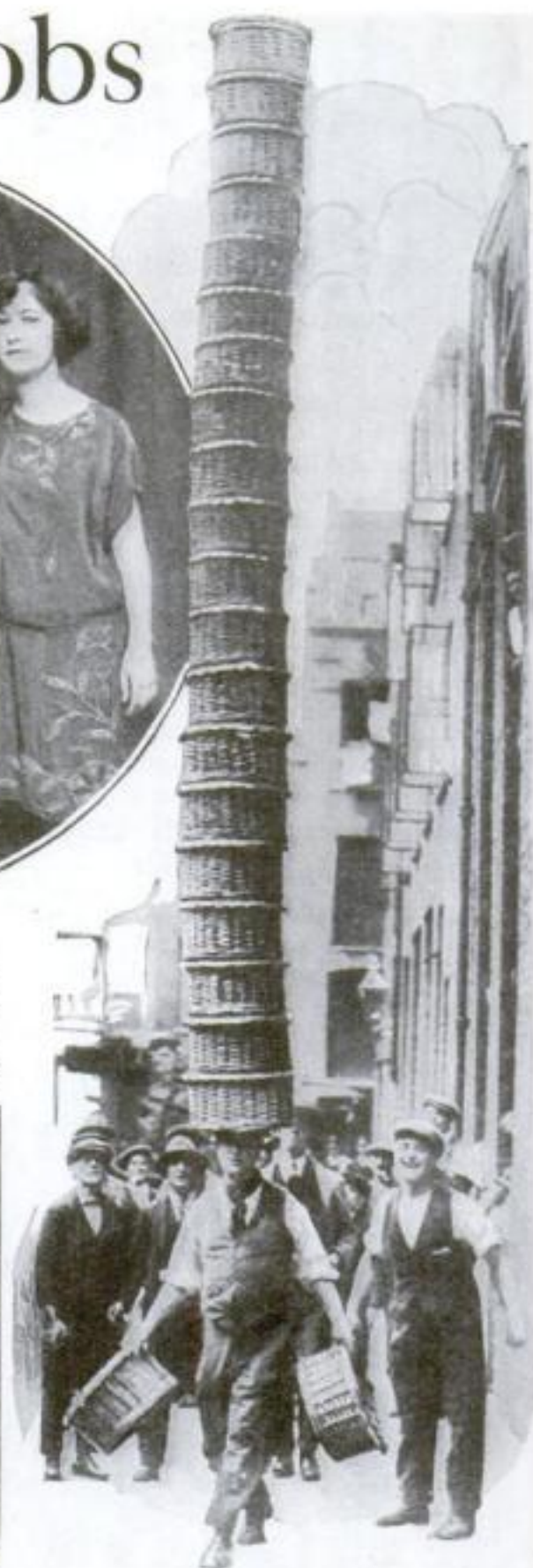
Unique Bow and Arrow Maker

In a little shop in Jersey City, N. J., James Duff, who was born in Scotland, makes expert archery equipment for the leading archers of the world. The bows are made of lemon wood, tipped with South American horn, and the arrows are fashioned from straight and light Norway pine



He "Sculps" in Sugar

Pompeo Coppini, a noted sculptor, is seen in the above photo at work on the bust of Miss Katherine Kohler, which he modeled from Cuban sugar for the recent Cuban Exposition, New York



Fine Head Work

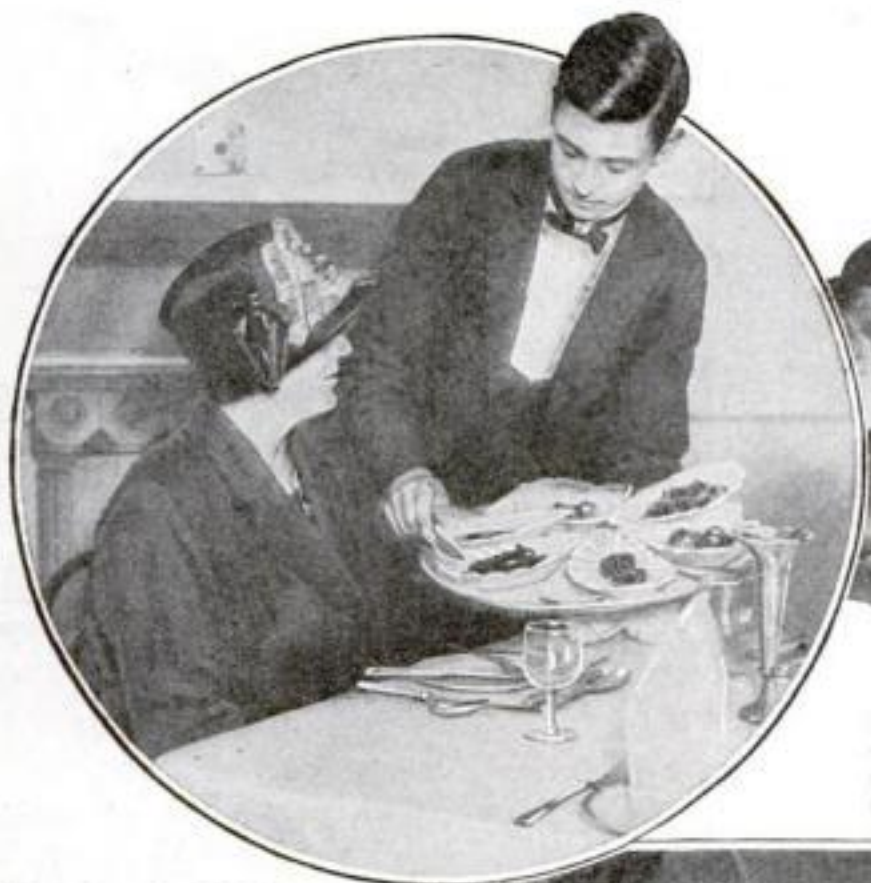
The above picture shows James Sainsbury of England carrying 20 bushel baskets on his head. Sainsbury is Great Britain's champion basket carrier and the above feat gave him the world's record in that line



Crippled Artist Creates Marvelous Figures in Sand

On the sands of San Francisco's Ocean Beach, Ernest Woods, a sculptor, minus both legs, recently has been creating a series of beautiful studies. The above picture shows the crippled artist and his dog, with one of his creations of sand

Odd Things Taught in Schools

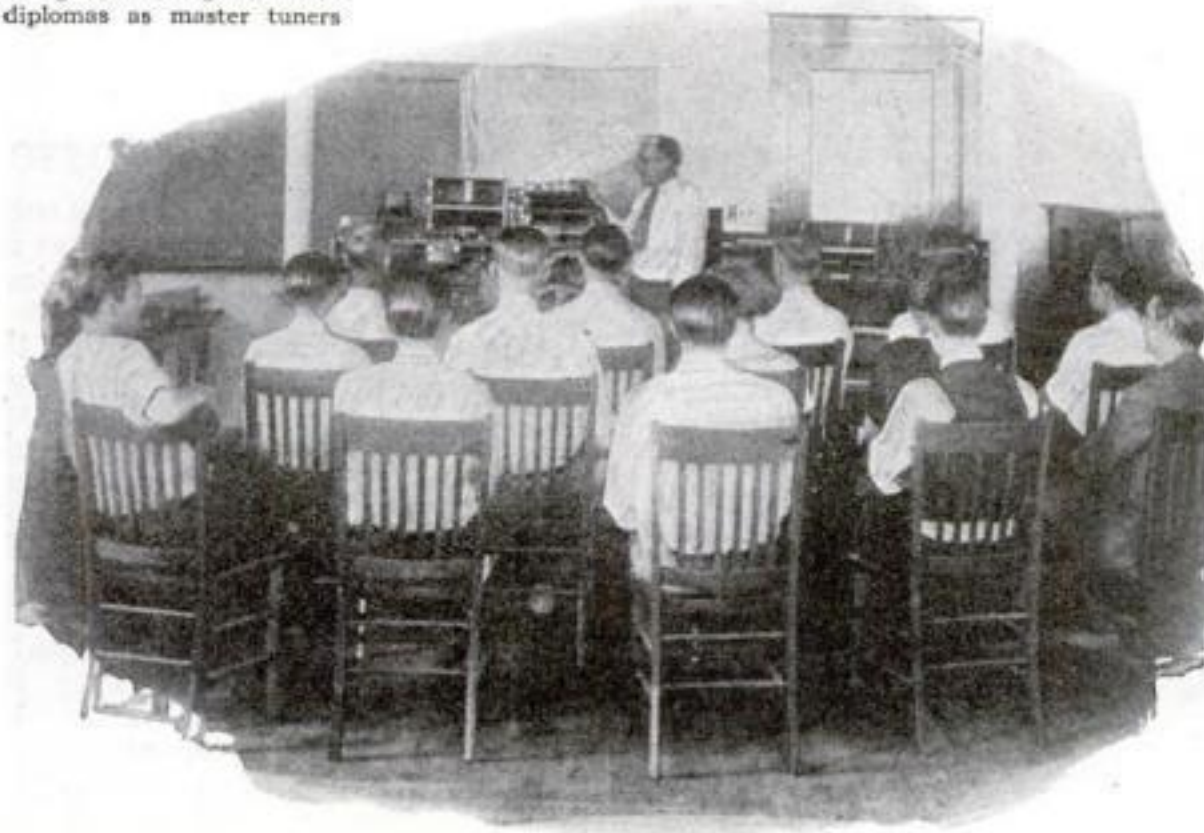


A Course for Waiters

The Westminster Technical School of London has undertaken to train British boys to become expert waiters and chefs. Britain has declared war on foreign waiters, and the best hotels in England eventually will employ only native help. Above: One of the students of the school snapped while waiting at table. Guests are provided for students to practice on

The Tuner's Turn

The picture below shows a class in piano tuning. The town of La Porte, Ind., has the only college in the world devoted exclusively to the education of piano tuners. The school, endowed by William R. Powell, the president, is equipped with dormitories, laboratories, and private studios. The pupils on graduating receive diplomas as master tuners



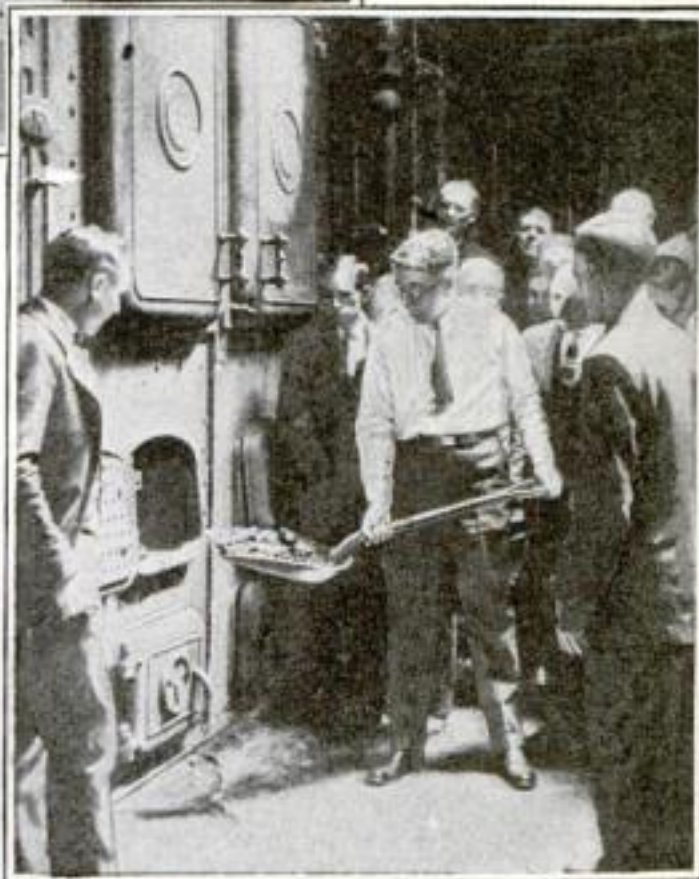
Training England's Future Housewives

In a remarkable school established recently by the Institute of Hygiene in London, hundreds of English girls attend practical demonstrations of scientific methods of economical and sanitary housekeeping. Here an instructor is showing a group of students how to test tea and to detect excessive stalk that may be weighed with it



Course in Hotel Management

Hotel management is a business calling for a certain amount of technical training. Cornell University decided to meet the need, and today has a regularly accredited course for this subject. The picture to the left shows pupils of the hotel management classes getting practical first hand instruction from Roger Cretaux, chef of Hotel Roosevelt, New York City



Now the Janitor Goes to College

The Colorado State Teachers' College, Greeley, Colo., has classes in janitor engineering. Men are taught how to fire, heat, plumb, repair, clean, and ventilate a furnace. Above: Professor J. D. Ball shows his class how to build fires in approved style

A Club for Retrieving Golf Balls



CAPTAIN C. L. MIDDLETON, of Washington, D. C., has invented a novel device that he calls a "fisher for golf balls," a cuplike scoop, at the end of a handle, with holes in the bottom to let the water run out. This handle is telescopic and when collapsed is but little longer than a golf club. In general appearance the golf-ball fisher looks like a driver or brassie and may be carried in one's golf bag with other clubs. The picture at the left shows the "fisher" collapsed. The man on the right is retrieving his ball from a water hazard.

This tie case holds and presses four scarfs, and it can be folded to the size of a neat pocketbook



A Convenient New Case for Pressing Your Ties

THE London man of fashion is keeping his ties smooth with this new tie press, which soon will be introduced in America. A stout piece of cardboard is inserted in each tie, keeping it stretched in shape while not worn. There are four pockets in the case holding four ties. The case may be folded to pocketbook shape.

Bicycle Pump Used to "Break in" Pipes

AN INGENIOUS English tobacconist employs an ordinary bicycle pump to "break in" new pipes for his customers. After the pipe is loaded the stem is connected with the pump, the light is applied, and the pump handle worked slowly until the tobacco is consumed. The pipe then is laid aside to cool, and the process is repeated. The taste of the wood is thus destroyed.

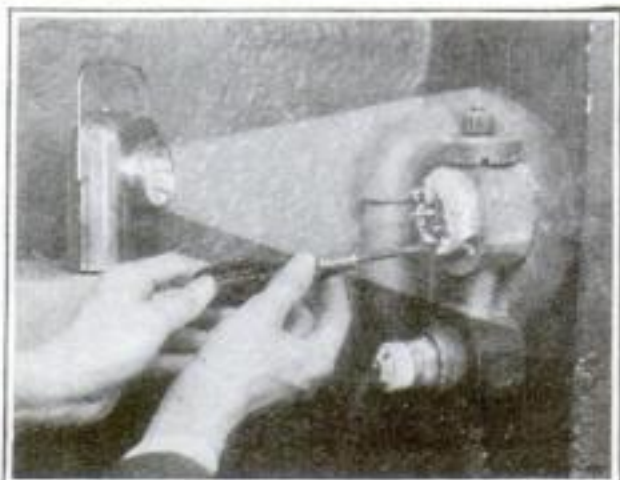
To Protect Your Baby's Bottle

THE inventor of the "baby bottle protector," which is shown at the right, is Mr. Joseph McCrink of Newark, N. J. This device, made of one piece of rubber, can be put on or taken off in a few seconds. The ribs of the protector make it easy for a child to hold the bottle, or they also can be used to tie the bottle to the crib.



Germany Produces Sheet Steel as Transparent as Glass

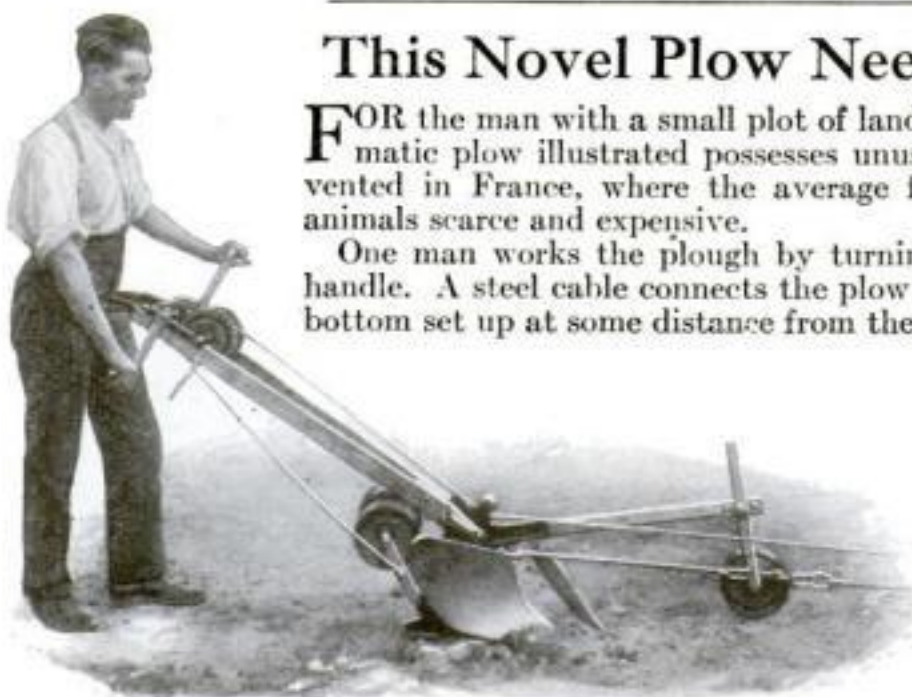
SHEETS of steel so thin that they are transparent recently were produced by Dr. Karl Mueller of the Technical Institute of Berlin, Germany. The test plates used to determine the transparency of optical glass, and ruled with lines one twenty-five hundredth of an inch apart, were photographed through such a metal sheet. When enlarged to four hundred diameters, the scale lines showed distinctly, without distortion.



A Flashlight Lantern for Awkward Places

FOR awkward jobs in obscure places, where the old-time flickering lantern once was used, a new flashlight lantern has been designed. It stands on its own base and projects a constant, steady light on any spot, leaving the workman's hands entirely free for work.

A handle forms part of the lantern so that it can be hung on a nail or suspended from the workman's belt. It was designed for general use around the house as well as for motorists. The light uses three standard unit cell batteries.



The man in the above illustration is demonstrating the latest automatic plow that has been invented for the small-sized farm field

This Novel Plow Needs No Horse

FOR the man with a small plot of land and no horse, the automatic plow illustrated possesses unusual interest. It was invented in France, where the average farm is small and draft animals scarce and expensive.

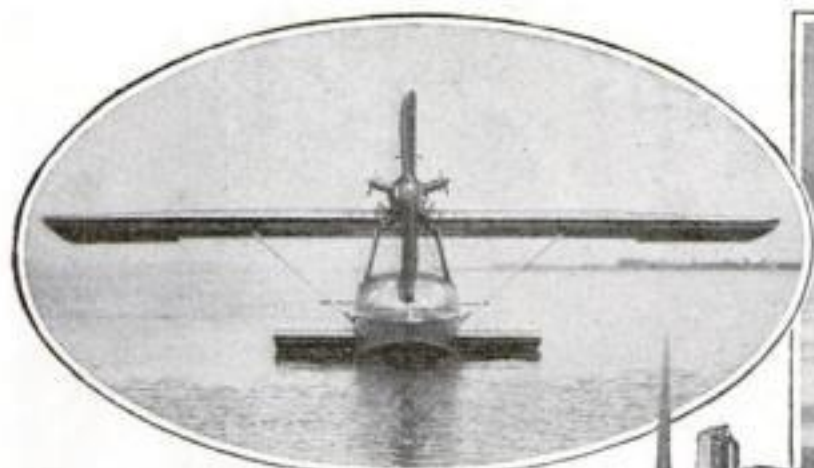
One man works the plough by turning a hand winch on the handle. A steel cable connects the plow with a stake with spade bottom set up at some distance from the plow, which also aids in making a straight furrow. The winch with a system of pulleys draws the plow forward. It is geared to three different speeds and is said to have the equivalent of $1\frac{1}{4}$ horsepower when in operation. The height of plow can be adjusted to suit.

How Much Do YOU Know about Science?

THE following questions were selected from hundreds that daily are received by POPULAR SCIENCE MONTHLY. How many of them can you answer? They concern facts of the world in which we live. After you have tested your knowledge of things we should all know, turn to page 158 to discover how many of the 12 questions you were able to answer correctly.

1. Are the winters more severe than they used to be?
2. Why does pepper burn the tongue and not other parts of the body?
3. What is the advantage in having two eyes?
4. How can we use the Big Trees in California to determine the climate in the time of Christ?
5. Why is it that the ostrich cannot fly?
6. Can we see all of the moon?
7. What is ozone?
8. Why does a silver spoon help to prevent a glass from cracking when hot liquids are poured into it?
9. Why are some parts of the earth desert?
10. Is there a sea serpent?
11. Why does paint keep iron from rusting?
12. Why does cold make us shiver?

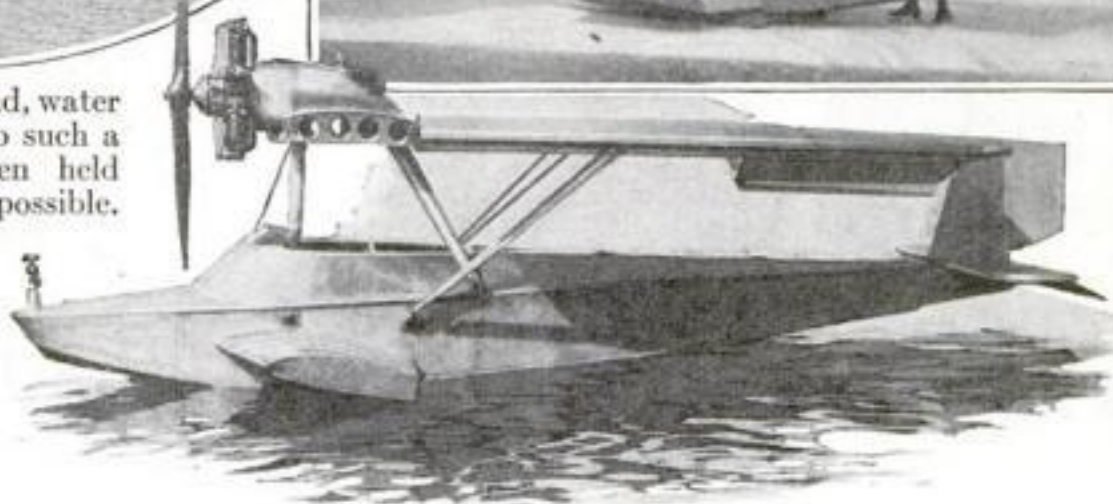
New Plane Takes Off from Land, Ice, or Water



A BOAT that will fly from land, water or ice! Twenty years ago such a marvel would have been held highly improbable, not to say impossible.

But so rapidly have the wheels of scientific invention gone round in the last 20 years, that such a boat has been built and such a boat actually was put in operation recently in the Great Lakes region. It is a 60-horsepower, all metal flying boat, with space for three passengers.

This machine, which is called the *Dornier Libelle*, is said to be the only plane that can land on ice or water without the aid of skis. When used on ice or water, its wings fold back, lessening the resistance. It is narrow enough in this



The "Dornier Libelle"

The upper left illustration shows how the baby plane rises from the water. At the right is a picture of the plane ready to rise from the ice. The third photo shows plane on the water with the wings folded

wingless condition to fit into an ordinary moderate sized motor boat shed.

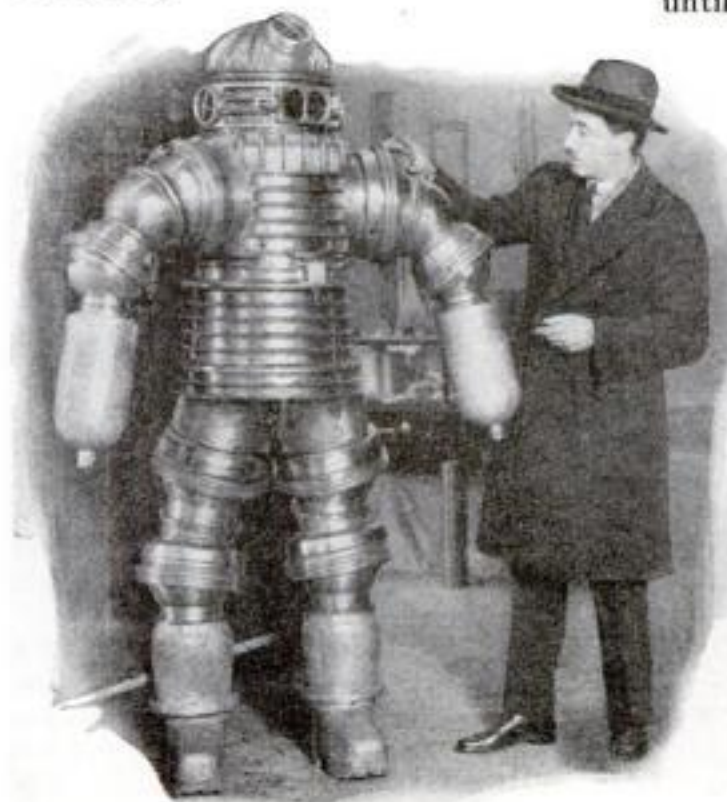
A boat like this that can alight on and fly from ice as well as land is a means of saving islands in the Great Lakes region from dangerous isolation in the winter.

Previously, forced landings of hydroplanes on ice invited disaster. In the February, 1925, issue of *POPULAR SCIENCE MONTHLY*, an interesting story was told of how Uncle Sam's postal service keeps in touch with these islands.

ELEPHANT grass and bamboo are used for the manufacture of paper in India, where there is a scarcity of wood and consequently of the more usual pulp material.

New Rustless Diving Suit

AN ENGLISH inventor, Mr. J. S. Peress of Byfleet, recently sent to the Shipping Exhibition, at Olympia, London, England, his newest invention, a rustless diving suit. It is made of rustless steel that guarantees, it is said, the free play of the joints at all times. The device was given a severe pressure test at the hands of experts. It is claimed that the new steel suit can be used at a depth of 650 feet.



The latest diving device

Insulated Fuse Puller

"SAFETY first" when you go to the fuse box, either to pull out or replace a fuse, will have you use a tool instead of your fingers. The new fuse puller illustrated is made of horn fiber and grips the fuse tightly until it is in



place. It comes in two sizes, one pocket size made in five leaves, and a giant size, seven-layered, with extra large capacity. The small size may be used for fuses up to 100 amperes and the giant size up to 400.

How Colder Water Guides Salmon

THE mystery of how salmon find their way year after year to their spawning ground, is believed to have been solved recently. Professor Henry B. Ward, of the University of Illinois, who has made an intensive study of salmon, discovered that temperature plays a large part in the fish's life. When it comes to a stream junction, the red or sockeye salmon, he says, moving against the current, always select the colder water.

Know Your Car

THE generator that supplies the electric current needed for the lights, ignition, and starter should be regulated to suit the driving habits of the man who owns the car.

The amount of current you need for keeping your battery charged properly depends entirely on the treatment the car receives. One owner may use his car for short runs with much stopping and starting of the motor, and he may drive mostly at night when lights are required. Another may use his car only for long runs during the daytime. The first requires a higher generator output to keep his battery charged than does the second individual. The time of year and the climate also must be considered.

To adjust your generator properly, follow these rules:

1. Move third brush to increase output if hydrometer reading of battery does not show at least 1280 most of the time.
2. Reduce the output if battery uses too much water. It should not be necessary to add water oftener than once in two weeks.
3. Reduce the output by half when you go on tours in summer.
4. Increase the output in cold weather. Your starter takes more current when the motor is cold.
5. Don't forget to clean the commutator occasionally. Gasoline on a rag will help remove the fouling.

Curious and Useful New Inventions

Something New in Men's Wear—a "Dickey Vest"

IF HE should forget and take off his coat, that would give him away, and some rude person might laugh. For the man in the illustration at the right is wearing the latest in men's wear—a backless vest. It is very economical, requiring only material for the front, which is held in place by a belt around the waist and a strap back of the collar. It slips over the head and buttons at the back. Another advantage of the dickey—a man can take off this kind of vest without first removing his coat.



A Bullet-Proof Shield for the Police

IN THE olden days, knights with their heavy shields weren't half as well protected as Chicago police today with the unique device illustrated above. This new bullet-proof shield fastens around the neck, leaving both hands free, and a large lens allows full vision.

In a tight place, once having cornered a criminal, police have been at a great disadvantage. When routed from their hiding places, criminals will shoot to kill the pursuing policemen.

Every police station in Chicago, it is said, will be equipped with the new shields, and they will go out with tear bombs as a necessary part of a policeman's fighting equipment.

Want More Helium

THE United States is the only country that has helium in large quantities. Germany is considering a suggestion that helium can be derived from monazite sand, which now is made into gas mantles.

From 15,000 to 20,000 cubic feet of the gas, it is estimated, could be recovered from the sand in a year, which is a thousandth as much as was lost in the *Shenandoah* disaster. This amount of helium would suffice for technical purposes, though not for the needs of dirigibles.

Look Out, Boys, for the Electrical Spanker!

JUDGING by the number of boys who visited the recent Electrical Show in New York City, the youths of the country are warmly interested in modern inventions. However, there was one exhibit that was not at all popular with the smaller boys. It was an electric spanking machine. The illustration shows how it operates, and we are waiting to hear if some community has bought one for its youthful wrong-doers.



The man shown in the illustration below is demonstrating one of the latest devices for a well equipped home—an electrical spanker, which spares the hand but effectively impresses the young culprit



New Zworkin Tube Starts Washing Machine

THE inventor of the Zworkin thermionic photo-electric tube is V. K. Zworkin, who fled from Russia after the war to escape the Bolsheviks. The tube is said to be a new wonder of this scientific age. Mr. Zworkin, it is claimed, is the first man to combine the photo-electric cell with the radio vacuum tube amplifier for practical purposes. At the recent Electrical Exposition held in New York he demonstrated the practical possibilities of his new tube, based on the mechanical power of light rays, by starting a washing machine.

Mr. Zworkin's device consists of a radio tube of a highly special character, an ordinary doorbell circuit, and an automobile headlight. By concentrating the light from the headlight upon the tube, an electric current flows through the plate or telephone circuit of the tube, which holds open a switch in the bell circuit. The current in the tube's plate circuit decreases instantly if there is the slightest interference in the intensity of the illumination of the tube, such as is caused by the passing of the hand in front of the tube or the shadow formed by a whiff of cigarette smoke.

Bright Plumage Is Birds' Protection

NOW comes a scientist who says that a male bird's gorgeous coloring serves the very utilitarian purpose of protecting him from his enemies.

At first thought the idea of bright colors protecting a bird seems ridiculous, but Dr. Austin H. Clark, of the U. S. National Museum, says, "You must remember the bird's eye. It's not like a person's eye. It has a much shorter focus, so that things look practically all in a single plane, without depth.

"To a bird, a landscape looks like a patchwork of light and dark pieces, each sharp and distinct. Against such a background, an object is least observed if it is bright. The gay plumage of the male affords protection from enemies of the air."

Strange Sources of Music



An Amazing Instrument
That Plays Music with
Beams of Light

Five Feet of Melody

The above photo shows Miss Una Fleming, of Los Angeles, Calif., with her five-foot ukelele, the largest instrument of its type on record. Miss Fleming, who is called the "Original Ukelele Lady," recently traveled to Hawaii with this huge musical instrument, where she no doubt found "Say It With a Ukelele" as good a way as any of conversing with the natives



A luminophone, an instrument that produces music by beams of light, is the latest invention of H. Grindell Matthews, who is shown with his device in the picture above. The luminophone has a keyboard of 37 notes, which release light beams from projectors, and these pass through perforations in revolving disks. The interrupted light rays hit selenium cells and are changed into electrical vibrations. The vibrations are magnified by a tube amplifier, just as in radio, and issue forth from a loudspeaker

He Is a Whole Jazz Band in Himself



A One-Man Orchestra

Henri Kublick, a Chicago vaudeville artist, doesn't care much whether the musicians' union goes on a strike or not. At his fingertips he has a whole string orchestra—banjo, harp, piano, guitar, and mandolin. The strange instrument giving all these effects, called a "banjocestrion," is his own idea and was made under his personal direction

"Singing Coconut" Is on the Way from Hawaii



Sicily specializes in wandering musicians who play half a dozen instruments at the same time. The above picture shows a one-man band of Taormina. Observe how this itinerant artist uses his whole body. A toss of his head starts bells a-tinkling, a stamp of his foot booms a big drum. With his mouth he plays pipes; his hands play an accordion and he has drums and a cymbal



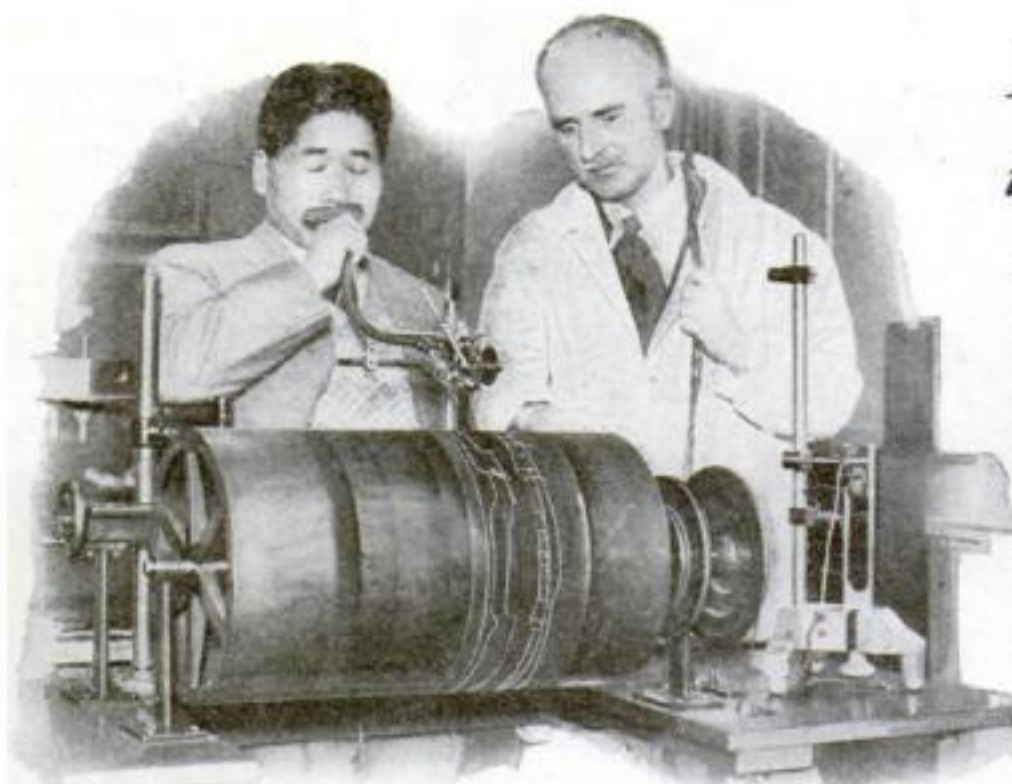
A Tiny Pipe in Los Angeles Organ

A monster organ was built some time ago at Los Angeles, Calif. The largest pipe is 32 feet long and three feet square at the "big end." Our illustration at the left shows the smallest pipe in this instrument—a pipe with a speaking length of not over three-eighths of an inch and a diameter but a little larger than a straw

Is the ukelele to give way to the *niu kani*, a new musical instrument from Hawaii? The sounding box is made of the polished shells of coconuts from the islands of Oahu and Kausai. Preparations are being made to turn out the "singing coconuts," as they are nicknamed, at the rate of 50,000 a year. David Kalawa, a foreman in a Honolulu music factory, is shown with three of the finished instruments and also the coconuts from which they are made

Automatic Signal Robs Fog of Its

*New Advances Made by Science
in the Conquest of Ignorance*



A Novel Device to Learn English Sounds

In the above picture, Prof. Daniel Jones, of the Phonetics Department at University College, London, England, is watching a Japanese student who is practising the pronunciation of English words on the kymograph. This is a new device that enables foreign students to see themselves talking. They learn to sound English words by the wriggling lines that appear on the kymograph. The lines are a guide to accurate vocalization.

Scientific knowledge is probably the most valuable conquest of the human mind because its discoveries invariably lead to practical applications that promote the happiness and comfort of us all. Each month we aim to give you in these columns the latest practical results of the newest scientific discoveries. By reading these pages you can keep abreast of the world's achievements.

FOG creeps up the Irish Channel. It grows denser. Then suddenly from a lighthouse comes the blaring, mournful blast of a foghorn. At regular intervals the warning is repeated.

If you climb up into this lighthouse in Dublin, Ireland, you will see no one, for the warning is automatic. The fog itself sets the signal going. This remarkable device is the invention of a young professor of the National University of Ireland—J. J. Dowling.

A huge lamp sends a strong beam of light slanting across the channel onto a large window in the lighthouse. This window lens concentrates the light on a light sensitive cell inside the lighthouse, producing an electrical effect that is magnified so that it operates an electrical relay. When the light beam is dimmed by fog, the relay current reverses, closing an electrical circuit that starts the foghorn.

Ships going by, birds, airplanes, or other passing shadows have no effect on the signal. Only persistent weakening of the light by fog operates the signal. The apparatus requires no attention, and for a year has operated successfully.

Serum for Broken Bones

BREAKING an arm, a leg, or even a hip may not be so serious an accident within a year or two. Healing broken bones of young persons may be hastened and the fractured bones of even old persons will knit together if the patient is

treated with a certain glandular extract, according to the indications of recent experiments in Japan.

Next to the thyroid gland in the neck are four tiny glands known as "parathyroid glands." An extract from these, when swallowed or injected, causes the percentage of calcium and phosphate in blood serum to rise, it is claimed. Large quantities of both these chemicals are needed in bone building. One reason why bones usually heal very slowly is because it takes a long time to extract enough of these substances from the blood.

Doctor Ogawa, a Japanese surgeon, recently has been experimenting with parathyroid extract in the Japanese medical academy of Keijo. He found that rats fed with the extract grew twice as much new bone as those not treated with it. It now is being tried out on human beings, and the results so far have encouraged the belief that the long weeks of wearing bandages and plaster casts may be greatly shortened.

A Fishing Thermometer

THE wise fisherman of the future will test the temperature of the water in which he casts his lines.

The Biological Board of Canada, after a detailed oceanographic survey, has found that haddock and cod, especially, are very particular about temperature. The cod will not stay where the water is freezing, and for him 50 degrees is unbearably hot. Between 40 and 45 degrees is about right, and if fishermen will fish there, it is claimed, they can scoop cod up wholesale. Haddock like water about five degrees warmer. The Board urges fishermen to use deep-sea thermometers and not waste time where there are no fish.



Measures the Movement of a Brick Wall

The U. S. Bureau of Standards has perfected a device that shows the deflection of a 40-inch brick wall under the slightest pressure. Above: J. E. Merritt is observing the deflection caused by the pressure of one finger. If you look into the eyepiece of this sensitive instrument while some one walks across the floor, the whole building seems to sway.

New Sugar Values

WHEN the average man thinks of sugar he thinks of the sugar used to sweeten his tea or coffee. To the chemist the word "sugar" has no more limited connotation than the word "alcohol." To him "alcohol" may mean wood alcohol or grain alcohol or propyl alcohol or butyl alcohol, or dozens of other alcohols—all of them substances that, in one way or another, are related sufficiently to be grouped under one division. Sugar may mean cane sugar or grape sugar or fruit sugar or milk sugar, or dozens of other sugars, all of them related more or less.

All sugars are more or less sweet; that is one of their most characteristic properties; though none of them even distantly approaches saccharine in sweetness.

Saccharine, which is several hundred times as sweet as any of the sugars, is not a sugar at all, but is obtained from working up coal tar. Despite its much greater sweetness, few of us ever use saccharine, because the body derives no heat value from it. But in dealing with sugar, no matter what the sugar is, we deal with a substance that is really a very valuable food.

The average weekly consumption of sugar is about two pounds, representing some 8000 calories in food value. Several professors at the University of Minnesota have just published a method for determining the relative sweetness of the various sugars, and they find that if the sweetness of cane sugar be represented by 100, fruit sugar becomes 173, grape sugar 74, and milk sugar 16.

Many Dangers

The interesting discovery is now made that fruit sugar, found in many fruits and particularly in honey, is more than $1\frac{1}{2}$ times as sweet as our ordinary table sugar. As might be expected, several enterprising manufacturers are already dreaming of a profitable market for fruit sugar.

A Quart a Day

MILK, we have been told of late years, is one of the most valuable of foods; most valuable because, more than any other food, it contains the elements so necessary to life and wellbeing. Relatively few of us, despite this view, seem to drink enough of it. Professor Sherman, of Columbia University, who probably knows more about milk than any other person living, has come to this important conclusion: children from the days of infancy to the ages of 14 or 15 should never receive less than a quart of milk each day if they are to grow to vigorous manhood; "and," he adds significantly enough, in his report to the World's Dairy Congress, "the quart a day had better be extended to all ages."

How We Rank

IN SCIENCE we're trailing along at the end of the parade, says Secretary of Commerce Herbert Hoover. In industrial research, applying known scientific facts, we are at the front with the best of them, but we fall behind when it comes to discovering basic facts for ourselves.

"Instead of leading all other countries in the advancement of fundamental scientific knowledge," he says, "the United States occupies a position far in the rear of the majority of European nations. A list of the awards of the Nobel prizes to men of various nationalities reveals the small proportion of first minds that we support. Other tests lead to the same conclusion, namely, that the number of first rank investigators developed in the United States is far below what our population, education, and wealth would lead one to expect."

The money set aside for research in pure science in this country is less than \$10,000,000, one-tenth of what we spend on cosmetics. Secretary Hoover terms this "absurdly small." Any one reading the list of Nobel prize winners below will be inclined to agree with Mr. Hoover and undoubtedly will be surprised to find that even little Holland, Belgium, and Denmark are ahead of the United States.

The Nobel Prize is by far the highest honor that can come to a man of science. It is a recognition that

he belongs to the class of immortals. Professor van Klooster, of the Rensselaer Polytechnic in Troy, has classified the Nobel Prize winners in chemistry, physics, and medicine according to the country from which they hail; and he finds that Germany heads the list with 24; then follow in order France (12), England (11), Holland (6), United States (4), Denmark (3), Sweden (3), Switzerland (2), Canada (2), Belgium (1), Spain (1), Italy (1), and Russia (1).

Iron Necessary to Life

AT THE mention of the word "iron"

most people immediately think of the tons and tons of iron ore in the Northwest, of the tons and tons of coal in Pennsylvania, of how the iron ore and coal are brought together to give us iron and steel and the kind of world we live in today.

We seldom think of a form of iron that we human beings and all animals must have if we are to live at all; and yet, whenever a man cuts himself in shaving, he sees a red liquid that owes its color to the fact that it contains iron. This red liquid, this hemoglobin, this iron-containing compound, is as necessary to life as the very air we breathe.

When we have too little of this precious fluid, we become pale, and the doctor refers to us as "anemic." He used to

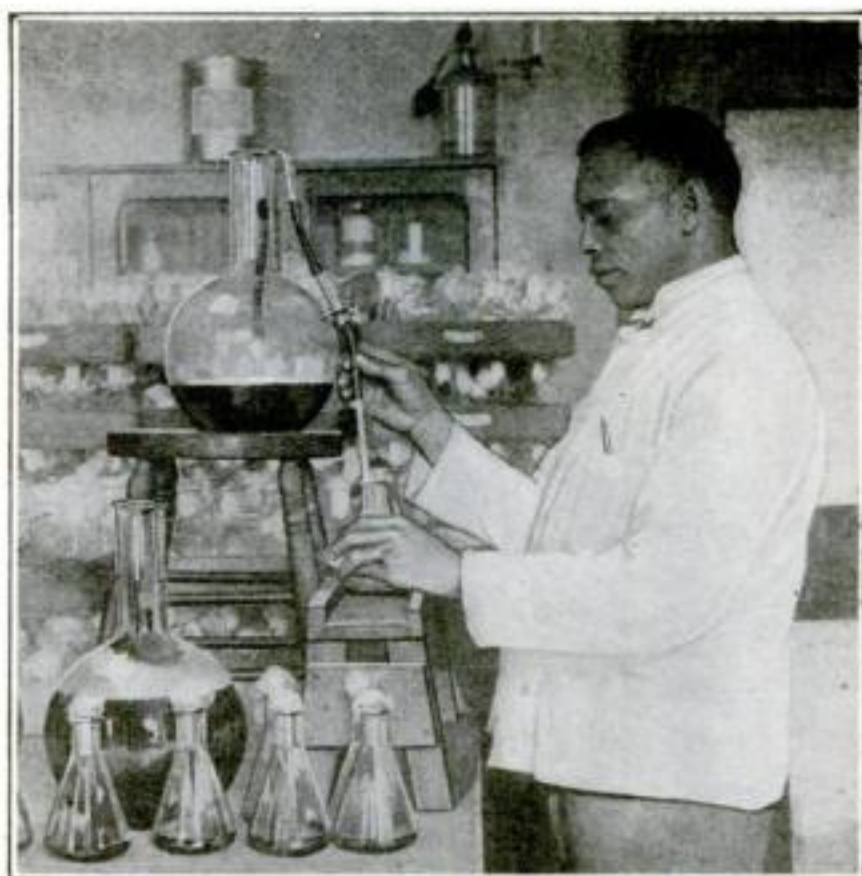
give us tonics containing iron, in the hope that the latter might take the place of the missing iron in the body. But it is interesting and important to note, from the most recent studies by eminent American physicians and food chemists, that less and less stock is being placed in tonics containing iron and more and more in foods containing iron. The specialists tell us that the yolk of egg, beans, wheat, beef, nuts, prunes, and spinach are among the foods rich in iron.

"Skim Milk" Products

WHEN you remove cream or butter fat from milk, so that butter and ice cream may be manufactured, you have left what is known as "skim milk." At present, something like 22,000 million pounds of skim milk are produced annually in this country. Until recently this enormous quantity of material was considered little less of a waste than at one time was the coal tar, out of which we now get all the dyes and drugs on the market.

Skim milk contains, among other things, casein, a protein and a valuable food. This same casein is now being put to some remarkable industrial uses. It is used for coating paper, for making glue, for making paints, in the printing of wallpaper and fabrics, and in the manufacture of a substitute for horn, celluloid, and hard rubber.

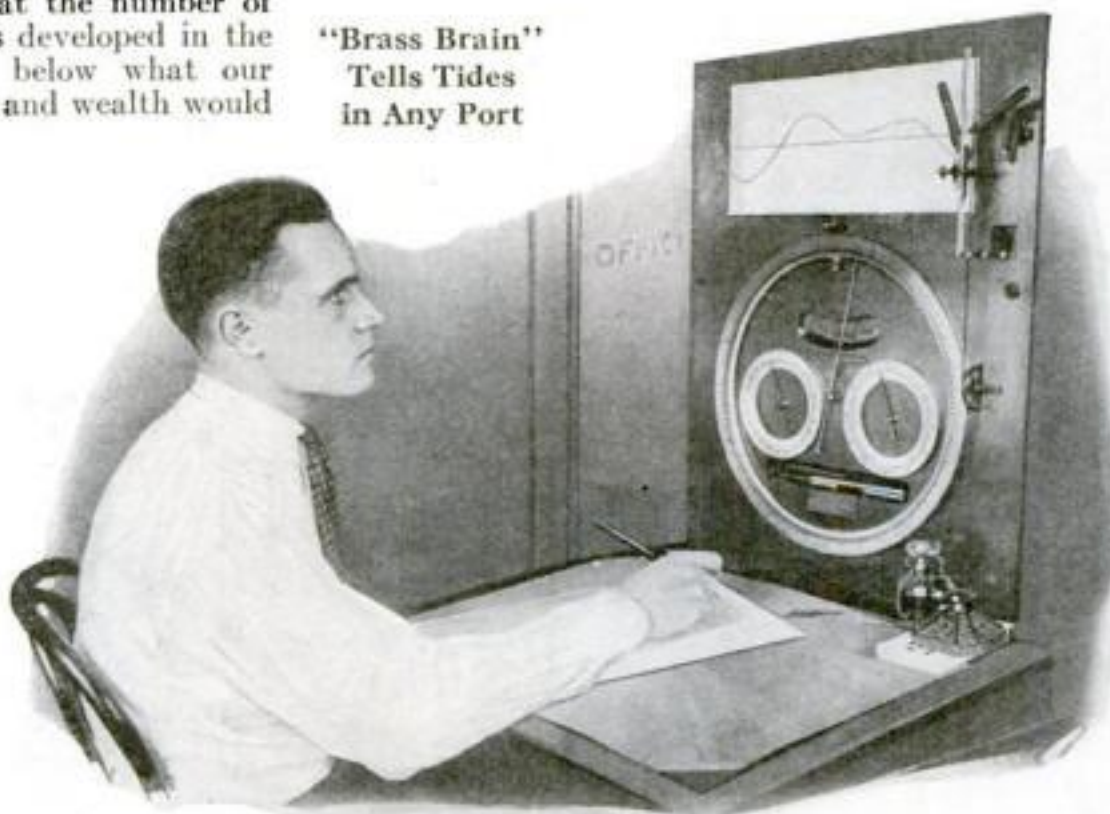
NIEPCE, who is known as the father of photography, made his first camera from a cigar box and lenses borrowed from his grandfather's solar microscope.



These Pampered Germs Require Dainty Dishes

In the laboratories of the U. S. Department of Agriculture certain rare germs are propagated for experimental purposes. They have to be fed with foods that contain egg elements, alcohol, etc. A special chef concocts their dainty dishes. In the photograph Chef William Garrett is making beef tea for these pampered parasites.

**"Brass Brain"
Tells Tides
in Any Port**



In the laboratory of the Coast and Geodetic Survey at Washington there is in constant use a device, said to do the work of 60 mathematicians, called the "Brass Brain." This machine can predict what the tides will be in any seaport in the world at any time—tomorrow or a 100 years from tomorrow. Its predictions have proved to be nearly 100 per cent perfect in the daily use to which it now is being put in Washington.

They Lighten

New Ways in Which Alert From Novel Broom-Mops



Self-Service Whisk Broom

With the whisk broom shown above, you can brush your own coat after it is already on you, without calling the family to help. The handle is at right angles to the bristles. Such a device is also convenient for brushing down stairs.



This Chopper Fits the Bowl

Some choppers are too small for your chopping bowl, some are too large. But the worst is the one which curves too much or too little. Here is a chopper curved to fit its own bowl exactly, and so save energy as well as temper.

Makes the "Real" Marcel

A "real" marcel—the flat, professional-looking kind instead of the casual wave of the usual home marcel—is produced by this new electric marcel iron. The iron is so grooved and hinged that the wave is back and forth instead of up and down. The heating element cannot become too hot.



Speeds Up Glass Washing

The ingenious device at the left will be welcomed in the home where there are many glasses to be washed. While the ordinary brush made for the purpose will do excellent work on the inside of the glass, this novel utensil has the advantage of washing inside and outside at one time. It is fitted with twin bristle brushes and extends from one single handle.



No Paraffin for this Preserve Jar

No paraffin or sealing wax is required with this new preserve jar. Metal clasps snap down over top, holding down the lid. The bottle will become air tight when ordinary pressure from both clasps has been applied.



It Seals—and Opens—Bottles

Bottle opener and cap in one, that is the ingenious device shown above. The cap is rubber lined and closes the bottle hermetically, keeping the "fizz" in the mineral water indefinitely. The other end is the opener.

For Crushing Ice

If you ever have ruined a towel trying to crush ice in it, you will appreciate the heavy canvas bag, illustrated at the right, devised for this purpose. A draw string at one end prevents the small particles of ice from escaping. The bag will stand the heavy blows of a hammer without tearing the strong material.



Bathroom Soap Pulverizer

To cut soap waste in the bathroom, a simple soap pulverizer, shown at the right, has been devised. It turns a cake of soap into powdered form as it is needed. The cake of soap is dropped into the container, and the turning of the handle pulverizes it.



An Auto Tea for Two

Everything needed for tea for two is contained in this attractive automobile tea case, even the alcohol fuel for boiling the water. One side of the case lets down to form a little serving table. Attached to the lid are receptacles for spoons and a small sugar container.

Woman's Job

Homemakers Cut Drudgery, to Self-Stirring Teapots

No Specks in this Milk

Keeping dust out of milk bottles is no small problem in these days of soft coal fueling. One solution is this new bottle top. It fits the neck of any milk bottle and makes an airtight cover. To open it, you press the spring lightly with the thumb



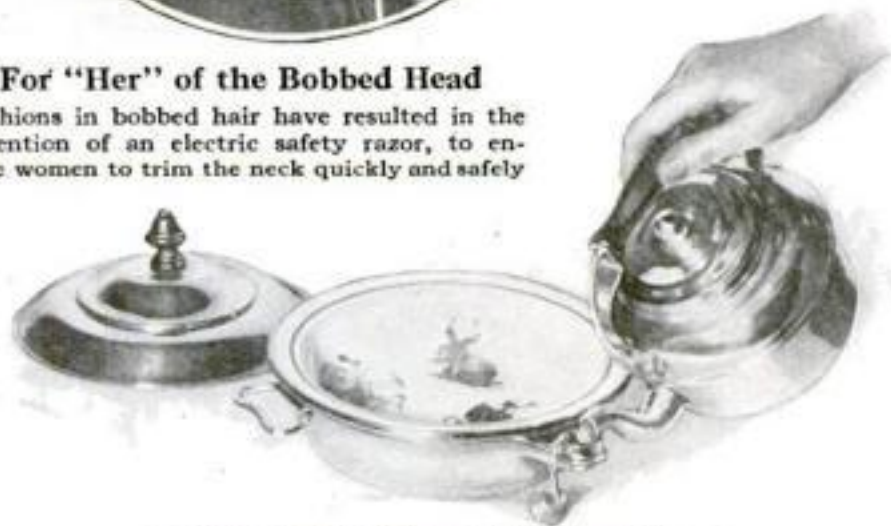
Novel Lemon Squeezer for the Tea Table

If you prefer lemon to cream with your tea, you will appreciate the novel individual lemon squeezer at the left. It will help keep your fingers from getting unnecessarily sticky, and save the tea napkins from lemon juice stains



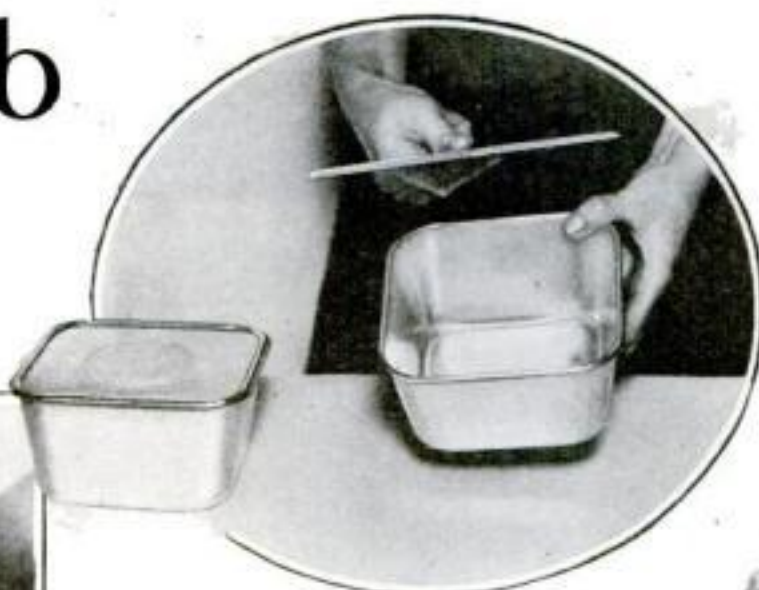
For "Her" of the Bobbed Head

Fashions in bobbed hair have resulted in the invention of an electric safety razor, to enable women to trim the neck quickly and safely



A Plate to Keep Baby's Food Hot

The baby's food can be kept warm for a considerable time in the attractive plate shown in the above photo. The plate, or dish, fits into a metal container which, in the picture, is being filled with hot water from a kettle. The lid that comes with this handy plate also helps keep the food warm



More Space in the Icebox

The pans shown above are intended for refrigerator use. The manufacturer has devised a square aluminum pan with a flat lid, because this type of utensil takes up the minimum amount of room in an icebox, and, it is claimed, largely eliminates the danger of spilling food in the refrigerator



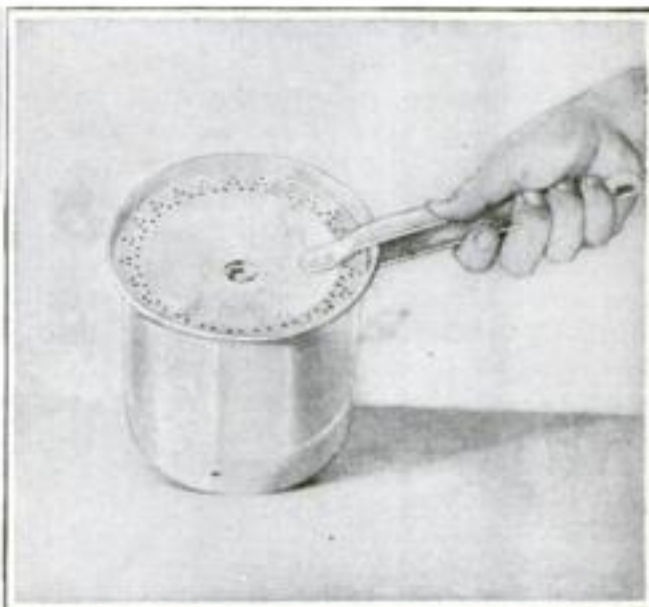
A Self-Stirring Teapot

All tea devotees know that tea should be stirred after the leaves have been left to steep. With the ordinary pot, you have to remove the lid and use a spoon. This one has a knob in the lid that does the stirring



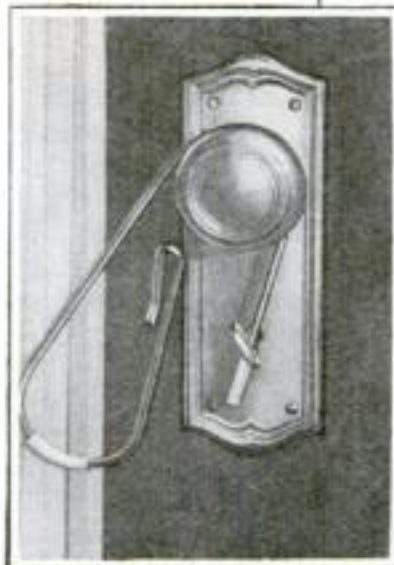
Mop or Broom—as You Like It

Above is a practical device for converting your broom into a mop. You simply slip the bag over the broom, and one handle thus serves for two implements. This mop has another advantage. When continued use has made it dirty, you can remove the bag and wash it



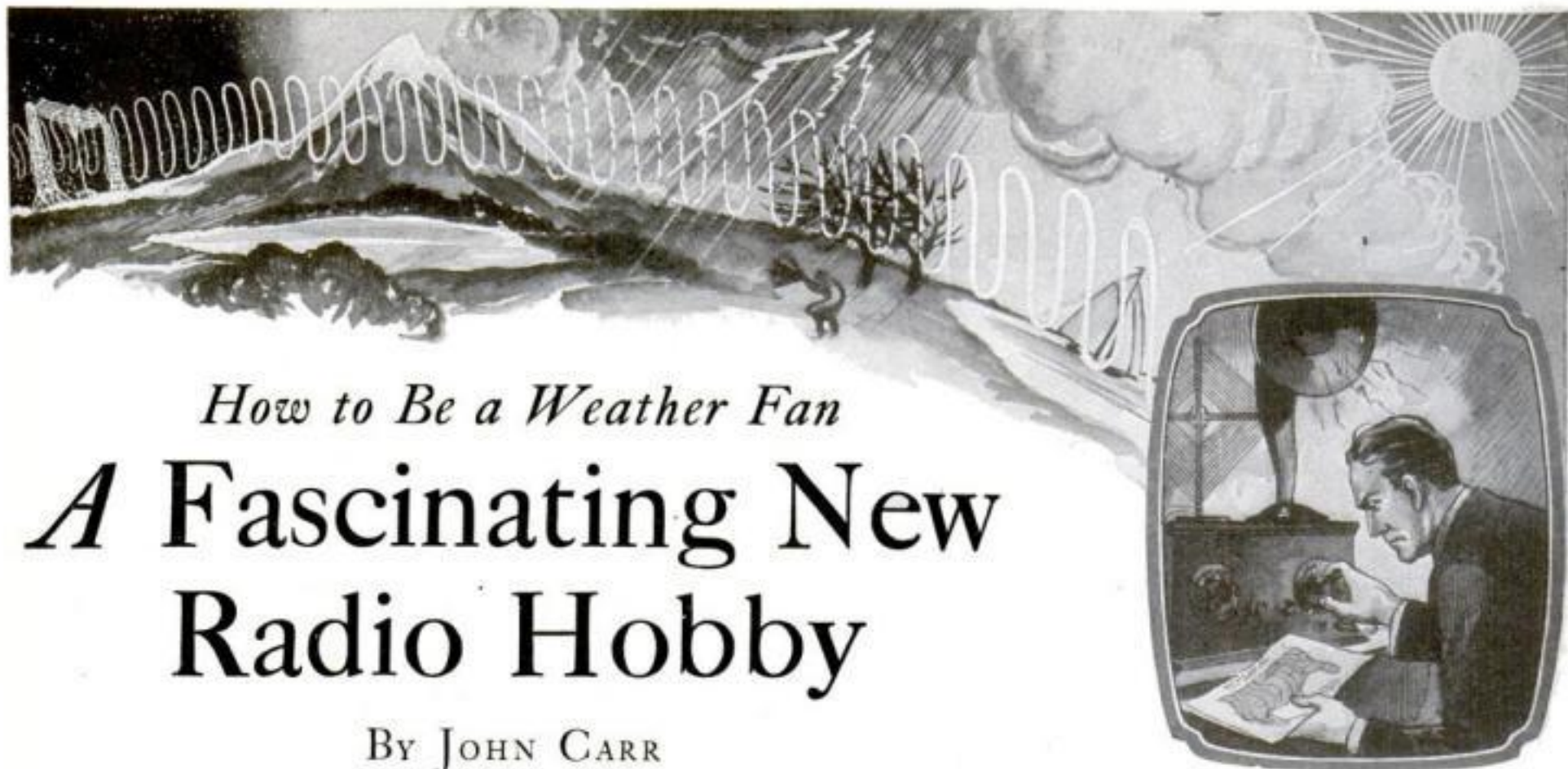
A Cooking Pot that Saves Your Food and Hands

The pot shown above has a base made of nickel-plated steel which not only prevents scorching, but keeps the food warm after turning out the flame. The perforated top prevents boiling over, and you can pour boiling hot liquids out of the pot without even removing the cover



Thief Can't Pry this Key Away

To the left is pictured a new anti-burglar device. If you slip this little wire contrivance over the door knob, the inventor claims, it will prevent burglars from pushing the key out of the lock or turning it while in the keyhole. Photo shows how the device is placed over the door knob



How to Be a Weather Fan A Fascinating New Radio Hobby

By JOHN CARR

DO YOU still get a thrill when you hear a station a thousand miles away on your radio receiving set? If the hunt for distant stations has begun to bore you, you may get a new "kick" from radio weather observation.

Hundreds of fans in every part of the country are beginning to manifest interest in efforts to solve one of Nature's most mysterious secrets—the connection between the weather and radio reception.

Why do signals fade out and then reappear with full volume? Why can't you hear a distant station as strongly tonight as you did last night? What causes static, and is there any way to prevent it? Just what has the weather to do with radio reception, anyway?

The search for the answers to these questions is the basis for a fascinating and growing new hobby—one that carries with it the possibility of discoveries of untold value to radio and to science.

The United States Weather Bureau has already been studying weather conditions in connection with radio reception. Several corporations, connected directly or indirectly with the radio industry, also are giving the problem thought. But, of course, its solution requires thousands of individual observations, and it is in supplying these that the individual experimenter and listener-in can participate.

F. M. HERRICK, of Rochester, N. Y., has prepared an analysis of the results of many nights of listening-in and of the relation between prevailing weather conditions, as shown by the United States Weather Bureau reports, and his reception. He has found, apparently, that there is a connection between atmospheric pressure in the areas lying between the broadcasting station and the receiving set. But, Mr. Herrick says, it will take a great deal more observation before definite rules can be formulated to predict with any degree of accuracy the possibilities of reception.

Getting started in this fascinating hobby is exceedingly simple. First you take a sheet of paper and rule it off as shown in the two charts on these pages. Then

you study the afternoon edition of the paper and jot down the necessary information about the temperature, barometric pressure, and the humidity of the air. After that you tune in as many stations as you care to. Each time you hear a station, jot down how loud it is, whether there is any fading, and anything else that seems unusual about the reception from that particular station, as compared with the reception at other times when you have heard it.

WHEN you decide to shut off your set, paste the weather map clipped from the paper at the bottom of your log-sheet. That's all there is to it. No expense at all, unless you happen to take it into your head to be your own weather observer, too, in which case you will need instruments. But, of course, your work can be just as complete and valuable if you depend entirely on the daily paper for observations.

The whole matter of the concerted study of the effect of the weather on radio reception is so new, that as yet no definite arrangements have been made to assemble the reports from radio weather fans for mass study. It is possible, however, that a department of the United States Weather Bureau will take up this work. If

not, a number of radio fans who have been active along these lines may organize an association to carry on the investigations.

In any event, your job as a radio weather fan will be to keep your log-sheets as accurately and completely as possible and file them away according to date. Then, when arrangements have

When Reception Was Good

RADIO WEATHER REPORT

Date March 2

City Rochester Type of Set Radio frequency
State New York Antenna 100 feet, 40 feet high

Time	Station	Temperature	Weather	Pressure	Humidity	Strength	Static	Fading	Remarks
7:15 AM	WEAF	16+	snow	30.18	74	loud	none	none	very good
8:00 AM	WBBR	"	"	"	"	loud	none	slight	fair
8:30	WTAM	"	clear	"	"	loud	none	slight	very good
8:40	WEEI	"	"	30.16	"	very weak	bad	bad	poor
9:30	WLW	"	snow	"	"	medium	none	none	good
9:50	WOR	"	"	"	"	medium	none	none	good
9:40	WFAA	"	"	"	"	medium	slight	slight	about average
10:00	WCX	"	"	"	"	medium	slight	bad	good
10:15	WOS	"	"	"	"	loud	slight	slight	good
10:20	WDAF	"	"	"	"	medium	slight	bad	fair
10:30	WLW	"	"	"	"	loud	none	none	very good
10:35	WWS	"	"	"	"	loud	slight	slight	good
10:45	WGY	"	"	"	"	loud	none	slight	normal

Name of Observer _____
Address _____

Here and on the opposite page are a few typical radio weather reports. Each wavy line on the map represents a different atmospheric pressure and runs through regions where that pressure prevails

been completed for an organized survey of results, you will be prepared to turn over a considerable amount of data to those authorized to direct the investigation. Further announcements along this line will be made in **POPULAR SCIENCE MONTHLY** or will be sent to you by mail if you will send in your name and address to the Radio Editor stating that you have taken up the study of radio weather.

YOU will gain an idea of the startling possibilities of this useful new scientific hobby, when you study the logsheets reproduced here. The one on the left-hand page was made by Mr. Herrick on a night that turned out to be extraordinarily good for radio reception. If you compare that sheet closely with this other one below, facing it, which was made on a poor night, you will see that good radio reception appears to be mostly from directions at right angles to the wavy lines drawn through localities where atmospheric pressure is the same. This seems to be true, at least, from these two logsheets; but it cannot be laid down as a general rule until a study is made of records taken by operators of radio receivers of various types connected to short and long antennas, in different parts of the country on the same night.

When Reception Was Poor

[illegible]

The observer who made these reports found that when the radio signals crossed regions of different atmospheric pressures, distant reception was better than when they paralleled the pressure lines



Reading the Weather

Your newspaper will give you the daily weather measurements, but they also can be read with a barometer, thermometer, and hygrometer.

You will want to know, of course, just what the lines on a weather map indicate, so that you can study your own results and see if you can find out for yourself any relation between the weather and radio reception. But before you can understand what the lines mean, you must know what the various weather measurements are and how they are made, from the thermometer and from the barometer.

You don't need to be told what a thermometer is—you probably have several around your home already. The thermometer indicates the temperature, and the notation of the temperature at the time of your radio reception is important.

Those black lines on the weather map indicate barometric pressure. Each line represents a certain pressure, and is drawn through points on the map where that pressure is noted on the day the map is made.

BECAUSE of the winds and the expansion caused by sunlight, the air pressure at any given point on the earth's surface is shifting constantly. Weather forecasters can tell by changes in the air pressure which way storms are moving, and this information may become important in forecasting the conditions which are conducive to good radio reception.

The original barometer, the instrument which measures the pressure of the air, consisted of a long glass tube closed at one end, filled with

mercury, and then inverted and set in a small container also filled with mercury. Air pressure at sea level will support a column of mercury only slightly over 30 inches high, and of course any change in the air pressure will show up immediately in the height of the mercury. This type of barometer is so simple that any radio fan can make one for himself. Almost all elementary books on physics give sufficient details for construction.

Many types of modern barometers are made so that any change in air pressure moves a diaphragm that covers a tightly sealed chamber. This motion is multiplied by levers so that it can be made to enter around a dial.

The third weather measurement is the determination of the relative humidity. In plain words, that means to find out how damp the air is. The instrument used for determining humidity is called the hygrometer, but it is much simpler than its name would indicate. You know, of course, that the evaporation of water reduces the temperature of the remaining water. That's why a wet bathing suit is so cold. It explains, too, why you feel so hot and uncomfortable in hot, damp weather—the perspiration refuses to evaporate and cool you off, because the air is so damp it takes up moisture very slowly.

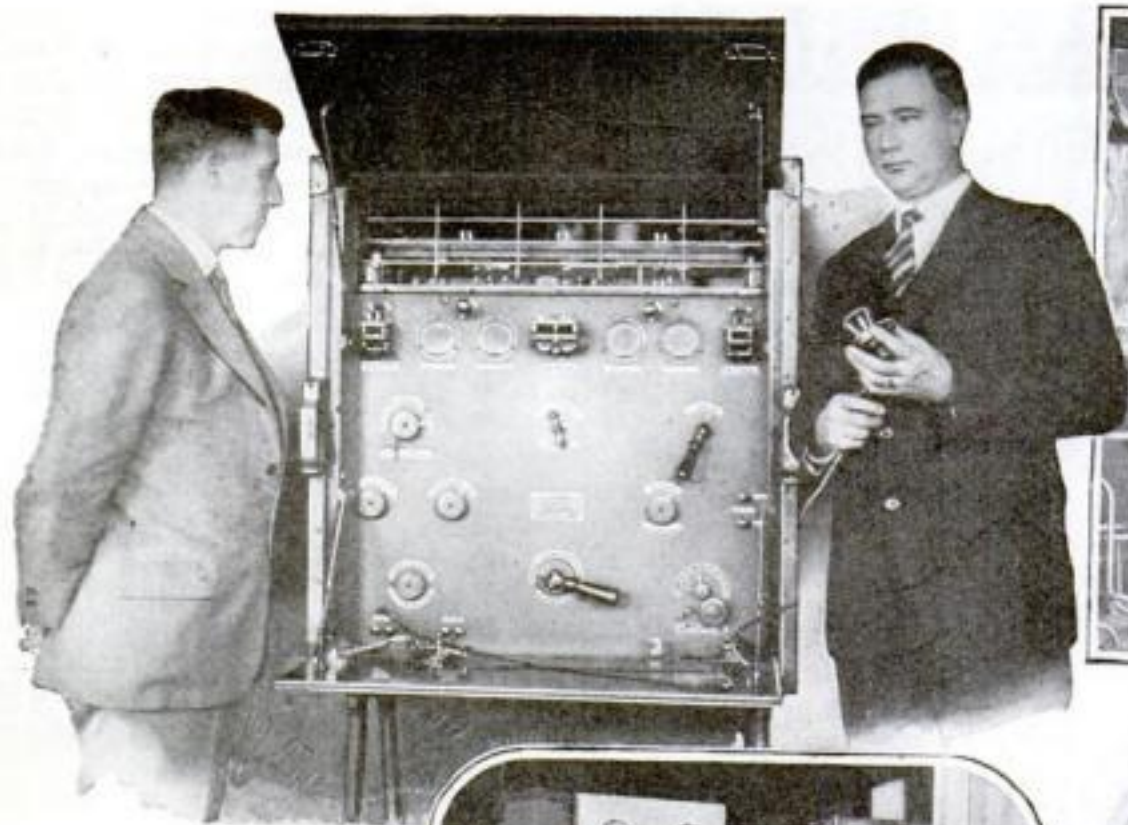
THE ordinary hygrometer consists of two plain thermometers. Around the bulb of one is wrapped a piece of wick-like cloth, one end of which is placed in a little cup filled with water. The wet cloth cools the bulb of the thermometer in proportion to the amount of dampness in the air. By noting the difference between the temperatures indicated by the two thermometers and looking up this figure on a specially prepared table, you can read off the humidity.

Just what effect damp air has on radio reception from distant stations is one of the things radio weather fans are trying to find out. Thus far no conclusive information on the subject has been obtained, or at least made public.

You have probably listened to your radio receiver on many hot, damp nights during summer. Usually the local stations, at least, are loud enough to drown the static. But do you remember the summer night when you idly twirled the dials and a distant station came booming in with mid-winter volume? You were astounded at the unexpected reception. And there were nights last winter when you couldn't hear a thing no matter what you did. Some day we are going to know the reason why radio behaves so.

You do not have to become a night owl to be a full-fledged radio weather fan. Whatever you are able to do will be a help toward solving the mysteries of radio weather, even if you are able to devote only a night or two a week to making a careful radio weather log.

New Products of Radio Genius

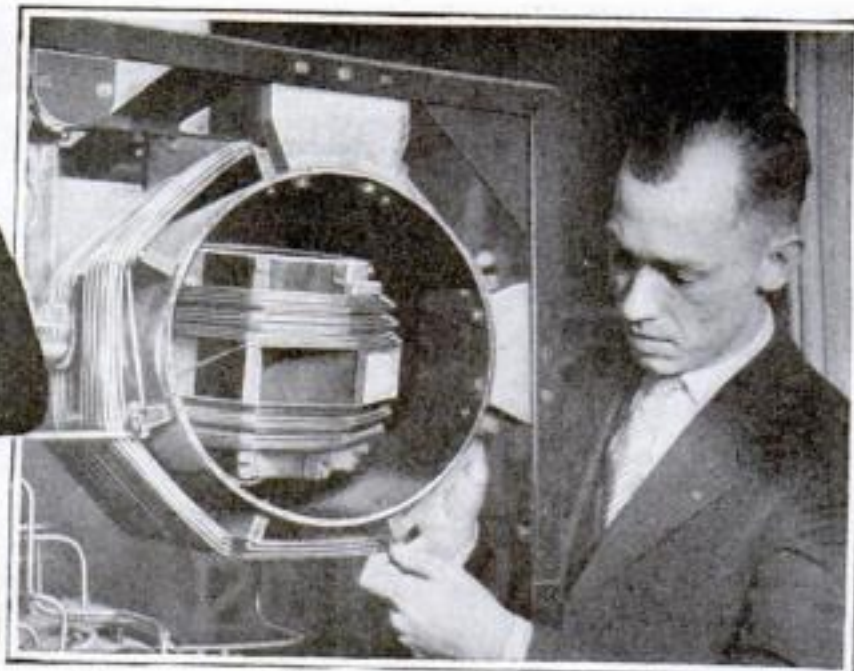


New Airplane Radio

The remarkable new type of airplane radio transmitter above has a power of 400 watts and can be used for phone or telegraph. It has a range of 100 miles for telephone work. Its telegraph signals can be heard for a distance of 350 miles.

Heard in Every State

Students of the Brooklyn Technical High School have built an amateur transmitting station that is so highly efficient its signals have been heard in every state. A single five-watt tube is used. Several shelves hold the apparatus, as in the illustration below.

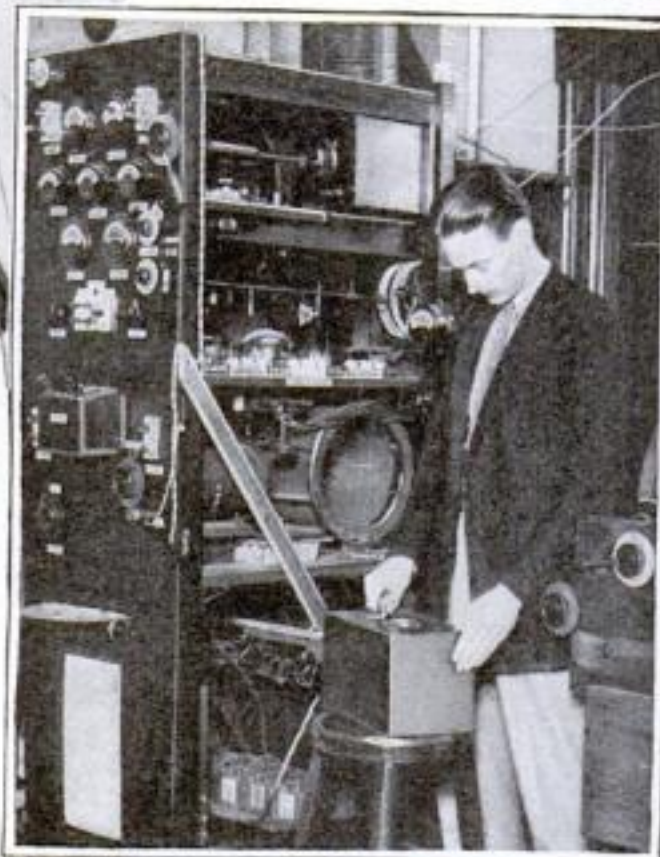


Copper Tubing in Huge Variometer

Resembling the ordinary small variometers, such as are used in radio receivers, this huge piece of apparatus is employed in a powerful radio transmitter. Because of the large amount of current it carries, the coil is wound of copper tubing, as shown.

Novel Fittings for Radio Masts

For radio fans who experience difficulty in erecting a mast on the roof for the radio antenna, the special fittings shown at the left have been designed to make the job a simple one, and to provide strong supports.



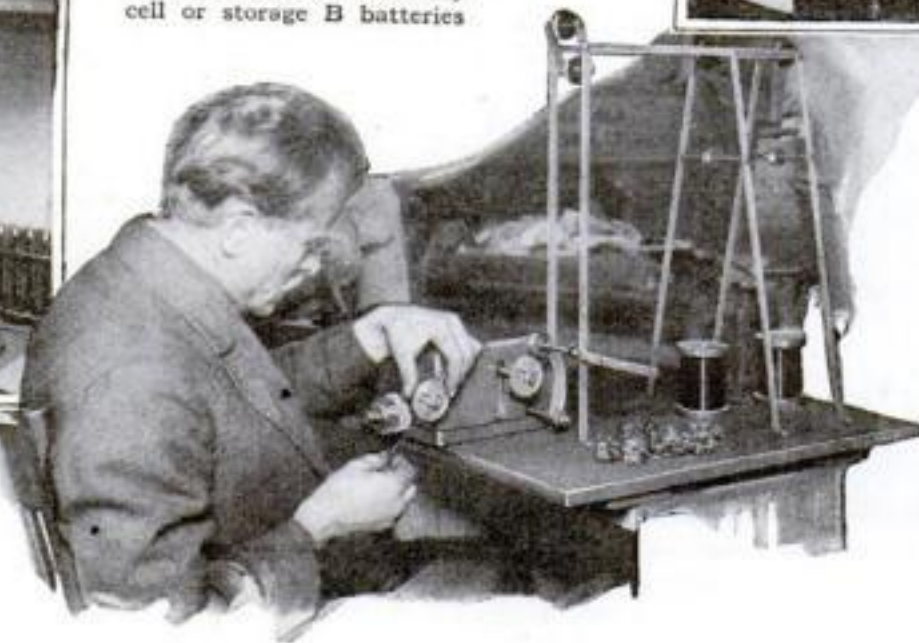
Doorbell Batteries for B Supply

For elaborate receiving and amplifying equipment installed (above) in the Cornell Club in New York, a large number of ordinary 1 1/4-volt dry cells were connected in series to supply the plate voltage, instead of the conventional dry cell or storage B batteries.



Marvelous High Speed Coil Winder

Head phones and loudspeakers are built with coils of very fine wire. The remarkable machine at the right winds the tiny magnet coils with fine wire traveling at the enormous speed of 60 miles an hour, without damaging wire or insulation. It operates automatically.



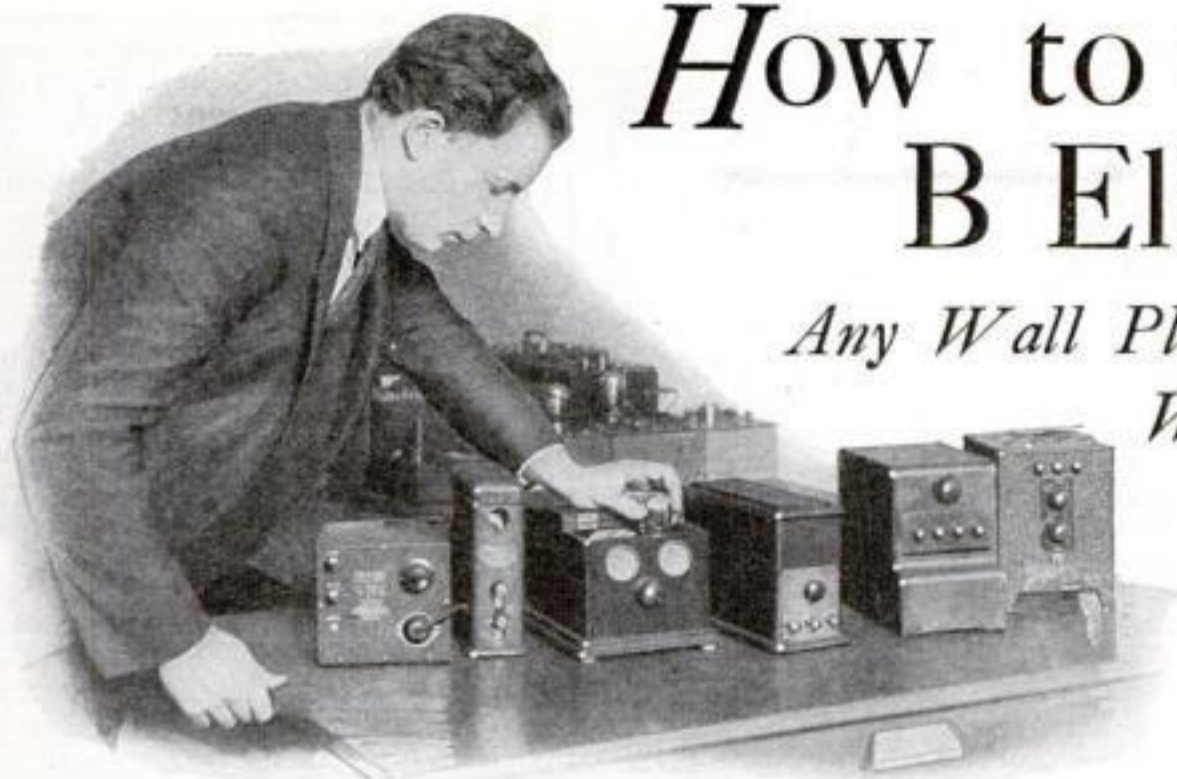
Simple Indicator Tests Broadcast Waves

The radio laboratory of the U. S. Bureau of Standards recently has designed an exceedingly simple frequency indicator, shown above, for use by transmitting stations. The need for very careful regulation of the wave length is great, because when a broadcasting station transmits on a wave a few cycles off its assigned frequency, serious interference with the programs of other broadcasting stations often results.

How to Use Radio B Eliminators

Any Wall Plug Will Serve You as Well as a Good Battery

By ALFRED P. LANE



Half a dozen different types of B battery eliminators being prepared for test by the Popular Science Institute of Standards. The Institute tests are rigid and include life tests for the rectifying element; also determination of maximum output, voltage, and absence of hum

THE REMARKABLE progress in the design and manufacture of B battery eliminators now gives you three possible sources of supply for the current to operate the plate circuit of your vacuum tubes. You can use dry cell B batteries, storage B batteries or one of the wonderful new B battery eliminators now on the market; and even the expert can not tell which is being used on your set, so far as results are concerned.

This means that you can substitute a B battery eliminator for the batteries you now are using without sacrificing either volume or quality. Of course you cannot expect to get better results with a B battery eliminator than you now get with good batteries—either dry cell or storage—give perfect current for radio uses. The big advantage of the eliminator that works from your house current is, of course, in cutting out the troubles you now have with run-down dry cells or the constant recharging necessary with a storage type of B battery.

It is entirely possible

to run a one or two tube radio set with a B battery eliminator, but the big advantage of the eliminator comes when it is used with radio receivers having five or more tubes. This is because the larger sets ordinarily require at least 90 volts from the B battery and the current drain is much greater than with the small one or two tube set.

Figure 4 on the next page shows the three sources of high voltage direct current now available. At the left is a standard style of heavy duty, 45 volt dry cell B battery. Two of these in series will run the average five tube radio set for from five to eight months, depending on

the number of hours it is used each day. In the center is a popular type of storage B battery consisting of 24 cells. Two of these batteries in series will give you 96 volts and with care they will last for five years or more. Such a battery requires regular charging at intervals of every two weeks and refilling with distilled water every two or three months. At the right is a typical B battery eliminator. These instruments supply 90 volts or more for the amplifier circuits, and an adjustable voltage for the detector tube.

MANY people cannot see why it is impossible to plug directly into their 110-volt house current to run their radio sets, just as they would for a vacuum cleaner or electric iron; nor do they understand what the B eliminator does to this current to make it usable for radio purposes.

Perhaps the simplest explanation is to point out that the sounds you hear coming from the loudspeaker are reproductions of variations in the electric current flowing through the 'coils inside it. And in order to produce recognizable music and speech, it is necessary to have a perfectly even flow of current on which to impress these variations. The ordinary 110-volt current supplied to most of our homes is of the alternating type. Instead of being a smooth and constant current it flows back and forth, so that there are usually 60 complete cycles or changes

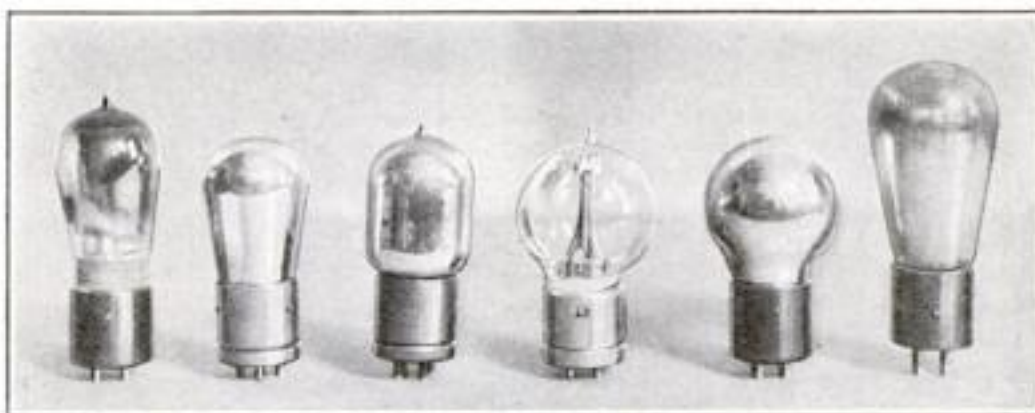


Fig. 1—Six kinds of modern rectifying tubes used in B eliminators. They are of two general types. Some operate by means of a heated filament; others, being operated without filament, utilize the ionization properties of a special gas

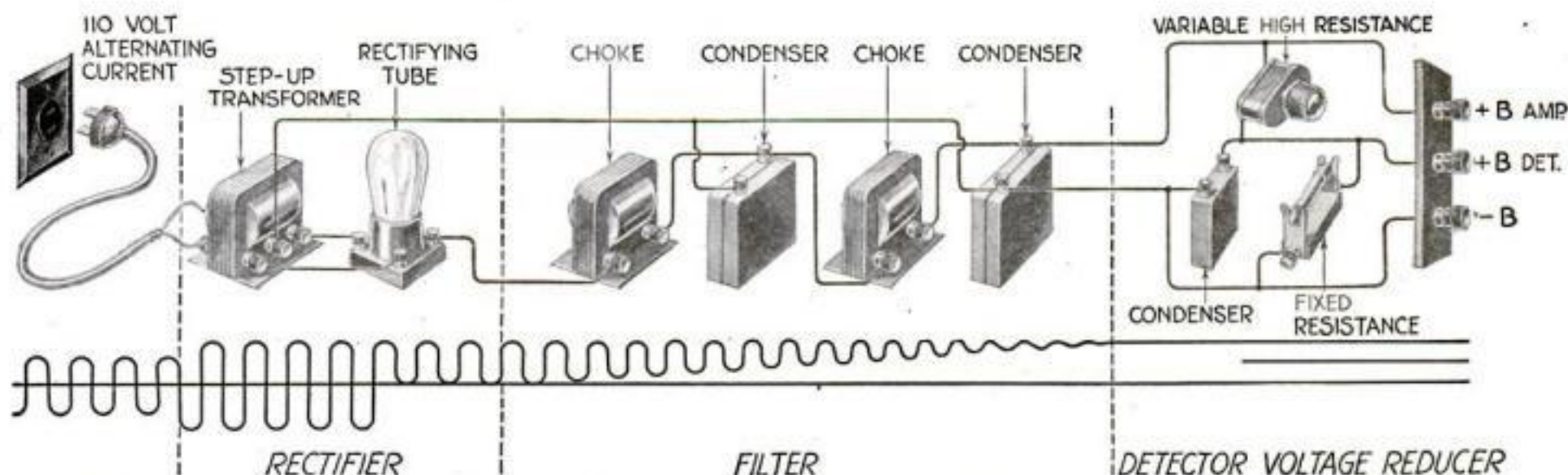


Fig. 2—This diagram shows how the different parts of a B battery eliminator are connected, and their functions in changing the 110 volt alternating house current into a smooth, even supply of direct current

for the radio set. At the bottom of the drawing is a graphic illustration of how the electric current is changed by the rectifier, filter, and voltage reducer. Each manufacturer incorporates his own ideas in this circuit

each second. In other words, each of the supply wires becomes alternately positive and then negative some 60 times a second.

What chance would you have to hear the relatively slight changes produced by the radio signals if they were impressed on a current violently fluctuating from positive to negative? None at all, for the broadcasting would be completely lost in the terrific 60 cycle hum.

The function of the B battery eliminator is, first, to change the alternating supply to a pulsating direct current, and then to smooth out the pulsations so that a perfectly smooth, even supply of direct current is available at the binding posts of the instrument. How this is done by the B battery eliminator is shown in Fig. 2.

YOU will note in Fig. 2 that a graphic representation of what happens to the electric current is shown at the bottom of the drawing. The current flowing out of the electric light plug is shown as a snake-like line indicating the result if the voltage variation were plotted with the straight line representing zero voltage. The first operation in any type of eliminator is to convert this alternating current to a pulsating direct current. Usually the alternating current is stepped up by means of a transformer to a somewhat higher voltage and then it is fed into a special tube that rectifies it, or the rectification is accomplished with electrolytic cells that permit current to flow through them in only one direction.

The next step is to feed this pulsating direct current into a filter system, consisting of a number of very high capacity condensers and one or more choke coils. The function of the choke coils is to resist changes in the rate of flow of the current passing through them without materially interfering with the flow of current that is not changing in amount. In other words, the choke coils act like springs in that they add voltage to the circuit as the supply voltage drops, and subtract voltage as the supply voltage increases. So the combination of the reservoir action of the large condensers with the balancing effect of the choke coils finally results in a smooth flow of direct current suitable for use instead of B batteries in your radio set.

THE remaining function of the B battery eliminator is to by-pass part of the current in such a way that a lower voltage is available for use on the detector tube. All good eliminators are so built that the detector voltage can be varied within adequate limits. Some of them also provide for a variable amplifier voltage.

There is nothing particularly new about the filter end of the circuit in a B battery eliminator.

The marvelous new developments that have made B battery eliminators practical for the radio fan are all in the rectifying

It's Simple to Install



Fig. 3—Simple installation of a B battery eliminator. Simply connect wires between the binding posts of the radio receiver and those of the eliminator, and plug the eliminator into wall socket. At right is seen the A battery. A cable holds all leads for battery and eliminator.



Fig. 4—Three different sources of plate circuit supply are shown here. Left to right: Standard heavy duty, 45 volt dry cell B battery; popular type of storage B battery consisting of 24 cells, and B battery eliminator.

end of the circuit. Today we have rectifying tubes capable of rectifying sufficient current to operate the largest of radio receivers and these tubes have an extremely long life.

Fig. 1 shows a number of modern rectifying tubes, which can be divided into two general classes. One general type, of which the tube at the extreme right is a popular example, operates by means of a heated filament. At the left end of the picture is an example of the class of tubes which operate without any filament at all. These utilize the ionization properties of a special gas to obtain the rectifying action. Both kinds give equally good results in circuits designed to take care of their particular characteristics. The filament types give up to 1,500 hours of service, or more hours than the most ardent radio fan is likely to run his set during a year.

THE average life of the filamentless type of tube is not definitely known. On test, such tubes have run more than 10,000 hours under full load with no apparent falling off in output. Others have given out in less than that time for reasons ordinarily traceable to some flaw.

The eliminators using electrolytic cells to rectify the current give as perfect service as the tube types if they use the new tantalum-acid combination in the cells. The elements of the cells last indefinitely and the only attention they require is the addition of a small amount of distilled water at very long intervals.

It is possible for the experimentally inclined radio fan to construct a good B battery eliminator using one of the remarkable new rectifying tubes, but the individual parts such as transformers, choke coils and condensers necessary to make up a satisfactory eliminator will cost you as much as a complete factory-built instrument. This means that home construction along these lines will be restricted to enthusiasts who prefer to build their own simply for the pleasure of the work involved.

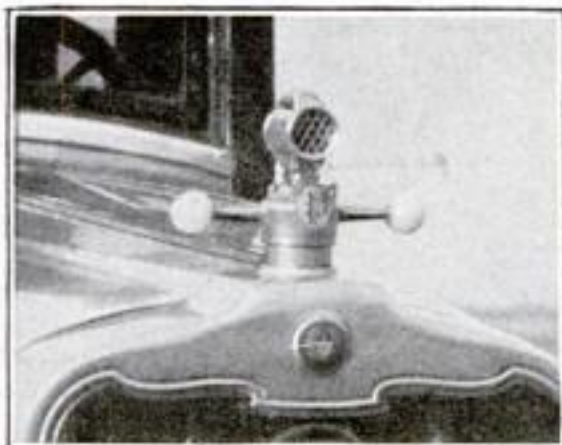
IN choosing a B battery eliminator all you need to know is the current consumption and the voltage requirements of your radio set, and then be sure to pick out an eliminator capable of supplying the amount of current you need at the voltage necessary for proper operation. And if you know nothing about these features, the dealer from whom you bought your receiver or the manufacturer will be glad to inform you.

Of course, there are poor B battery eliminators on the market just as there are poor radio receivers. Thus it will pay you to obtain the list of apparatus approved by the Popular Science Institute of Standards. This list includes the names of the various B battery eliminators that have been tested and approved. The Institute tests include operation of the eliminator on a number of typical radio receivers, as well as scientific tests to make sure the rectifying end of the eliminator will give a sufficiently long life.

THE installation of the average B battery eliminator is extremely simple. Fig. 3 shows a typical arrangement. Here the radio receiver is fitted with a battery cable that includes all the leads for both the A and B batteries. All that is necessary is to connect wires between the binding posts of the radio receiver and those on the eliminator. Now turn on the current from your A battery so that the tubes are lighted properly and then turn on the B eliminator by plugging in the wall socket and turning the switch if one is built into the eliminator. Now tune your set as usual. As soon as you have a station tuned adjust the detector voltage knob on the B eliminator until the signals are as loud and clear as possible. If the B eliminator also includes a method of adjusting the amplifier voltage, try changing this and leave the adjustment where the voltage is as low as possible consistent with full volume and tone.

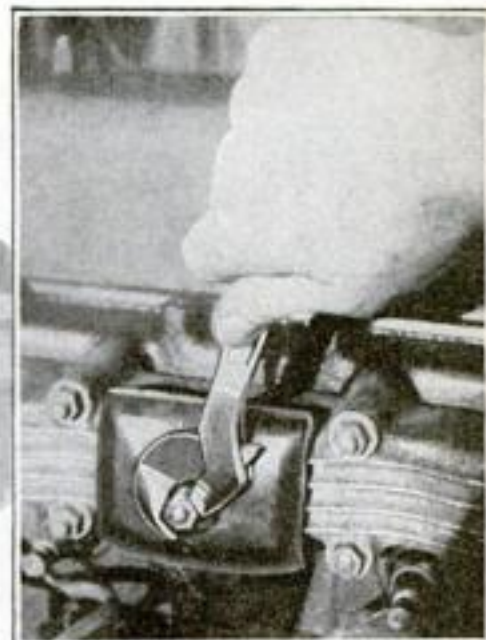
When you stop using the set it is always a wise precaution to disconnect the eliminator before you shut off the tubes.

Novel Auto Tools and Fittings



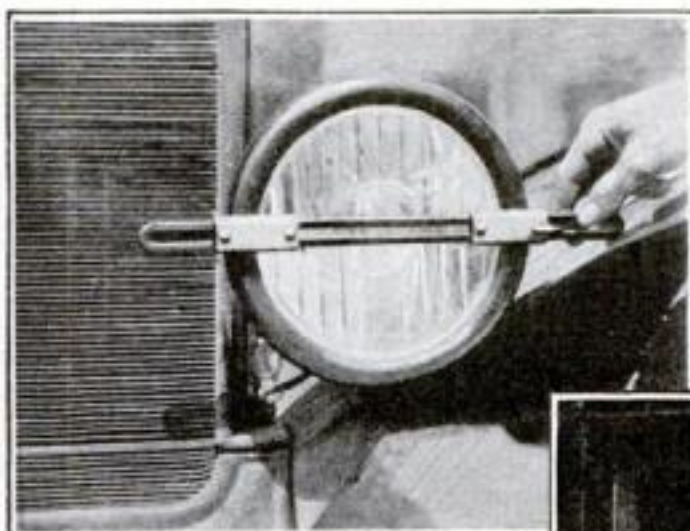
Condenser Saves Alcohol

When your motor gets hot during a warm spell in winter, the alcohol boils off rapidly. This little condenser, designed to take the place of the ordinary radiator thermometer, turns the alcohol vapor into liquid and returns it to the radiator for use.



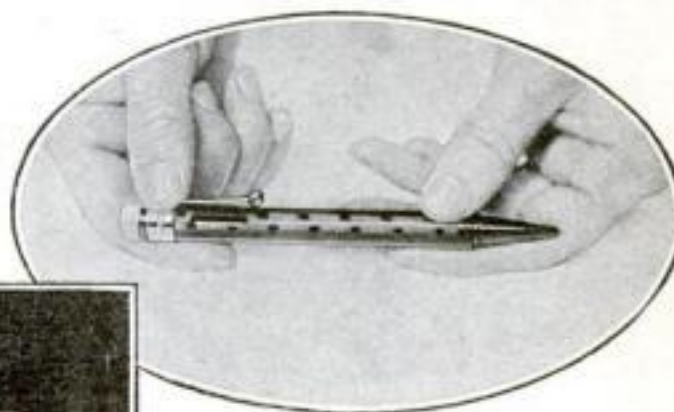
Wrench Holds by Cam Action

This remarkable new wrench is so constructed that the harder you pull on the handle the tighter it grips the nut. The jaw is arranged to handle any size nut with its grip of from $\frac{1}{2}$ inch to $1\frac{1}{2}$ inches.



Ingenious Lamp Keeps Motor Warm

Although this special lamp burns gasoline, it cannot catch fire, and even so drastic a test as pouring liquid gasoline over the lamp while it is lighted results only in putting the lamp out. It is made in three sizes capable of keeping the average motor from 20 to 60 degrees warmer than the surrounding air temperature.



Pencil Tests Spark Plugs

While there are many devices now on the market for use in testing spark plugs, the difficulty with most of them is that they are used so infrequently that they are misplaced and cannot be found when wanted. This new invention eliminates this difficulty by combining a spark plug testing bulb with a high grade pencil of the refill type.

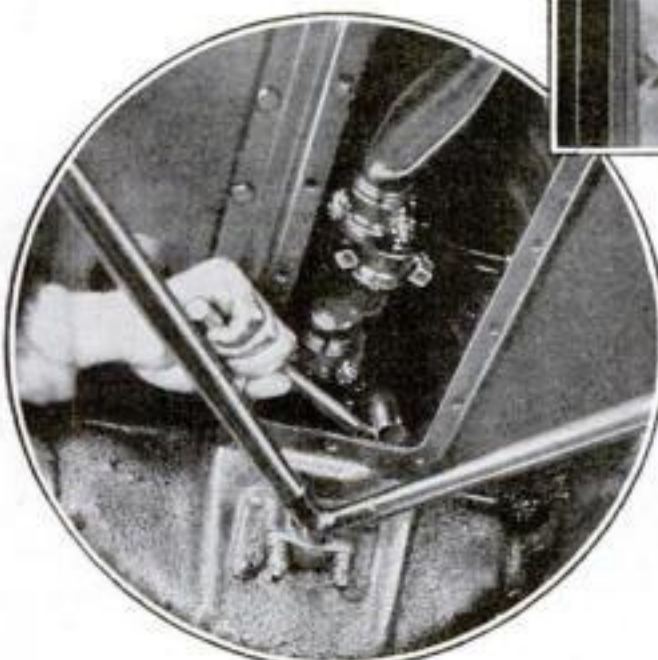
Handy Lamp-Door Remover

Every motorist who has struggled with an auto headlight door that has rusted in place will appreciate the value of this novel device in renewing a burned-out bulb. After placing the key on the diametrically opposed rivet heads, one hand is placed on either end and the door is easily removed with a twisting motion.



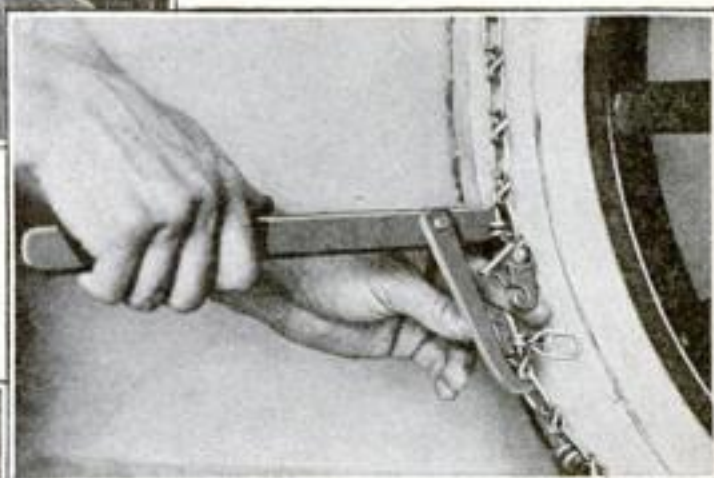
Ventilation Without Drafts

This device, fitted at the top of the side window, draws out stale air and forces in a fresh supply. Ventilation is important for closed cars in winter, and this device provides it without causing drafts.



Socket Wrench Works in Any Position

Many of the nuts and bolts on automobiles are difficult and sometimes impossible to get at with ordinary wrenches. The bolts holding the cap on the fourth connecting rod of the Ford is a typical example. The swivel action of the handle of this new wrench makes tightening this particular bearing a simple job. It is also useful on cylinder head bolts, water circulation outlets, main bearings and rim nuts.



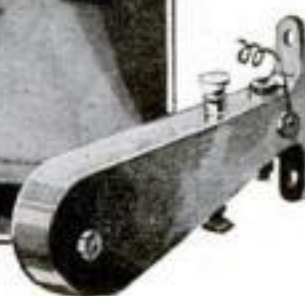
Simple Tool Hooks Chains Quickly

Chains should be run loose enough so that they will creep around on the tire, yet it is sometimes hard to pull them tight enough to make the hooks engage. The powerful leverage of this new tool does it easily.



Thief Alarm Blows the Horn

This novel device can be installed in any out-of-the-way corner on the automobile where the auto thief will overlook it. It is connected in the horn circuit, and when set for action, the slightest motion or jar sets it off and the horn blows, attracting attention to the thief, or frightening him away.



When Your Ignition Goes Bad

Gus Explains Why Spark Plugs Foul, and Why It Pays to Carry a Spare Condenser in Your Car By MARTIN BUNN

"**H**ERE is the most remarkable spark plug in the world!" asserted the salesman, as he swung his sample case up on the corner of Joe Clark's desk and opened the cover with a flourish. "Can't foul—gives the hottest kind of a spark—never breaks down—lasts forever—and you can sell it at a good profit." He shoved a couple of shiny plugs into Joe's hand.

"They look good," observed Joe, as he examined them. "Are they guaranteed not to foul?"

"Absolutely!" stated the salesman with much emphasis. "They're positively self-cleaning. See the peculiar shape of the recess back of the points? That shoots the exploding gas across the points and sweeps away any and all carbon."

Ordinarily, Joe consulted with Gus Wilson, his partner in the Model Garage, about any additions to their mechanical stock, but as Gus was out and so was the stock of spark plugs, he decided to take a chance.

"All right," he said after his inspection was completed. "I'll take two dozen."

A HALF hour later, Gus drove into the garage with the car he had gone out to test. The engine was missing badly, and blue smoke puffed out of the exhaust in great clouds.

"Hey, Joe! Bring out a handful of spark plugs!" he sang out, as he snapped off the ignition, and the engine died with a final spurt of smoke that rolled slowly across the floor in the form of a huge ring.

"Here you are," said Joe, as he popped out of his little office with some of the new spark plugs in his hand. "These will cure the trouble. I just bought 'em, and the salesman guaranteed them not to foul."

"Guaranteed 'em, did he?" Gus growled. "Well, here's where you have a chance to collect, I'll bet. This motor is a regular oil gusher."

As soon as Gus had the new plugs screwed up tight, he started the motor and it proceeded to run perfectly without a skip.

"They're the real thing all right, aren't they?" exclaimed Joe, with a satisfied smile.



The salesman told Joe that his "self-cleaning" spark plugs were guaranteed not to foul, —an extravagant claim which Gus soon proved to be "bunk" when he placed them in an engine in which the cylinder rings were passing oil and found they fouled like others

"Humph!" Gus grunted as though he had not heard. "That proves it's not valves sticking. It was running so rotten, I thought maybe the valves were on the blink. The trouble is the piston rings are passing oil, all right. Just wait a minute and watch what happens to your wonderful guaranteed plugs."

The partners stood there watching, as the motor continued to purr smoothly. Even the smoking became less and Joe's satisfied grin broadened. Then suddenly the motor skipped an explosion. The skip became more frequent and at last two cylinders cut out completely, so Gus snapped off the ignition.

"Now try to get your money back from that salesman!" said Gus, as he



Morrison thought condensers were only for radio sets until Gus took him to his test bench and showed him how a broken-down condenser caused his auto engine to stall

shoved the two badly fouled plugs into Joe's hand. "Don't let any high pressure hot air artist tell you there is such a thing as a real non-fouling plug. There ain't no such animal. So long as the piston rings are letting too much oil get by, and the heat of the explosions is cooking the extra oil into tarry soot and baking it into hard carbon, you can bet your last dollar that any plug in the world is going to lay down and quit on the job. Any good plug is a non-fouling plug if it's screwed into a cylinder that is performing properly."

"All that stuff about special chambers that shoot the soot off the points is pure bunk, because

the soot that gets on the points is not what puts the plug on the bum. It's the coating of carbon that forms on the insulator around the center point."

Joe's face registered extreme disgust, as he retreated to his office without saying a word.

GUS started to work on the car again, but he had only succeeded in arranging the tool kit to his satisfaction when the roar of a motor sounded outside the door, followed by a vigorous thumping that rattled that sturdy piece of woodwork on its hinges.

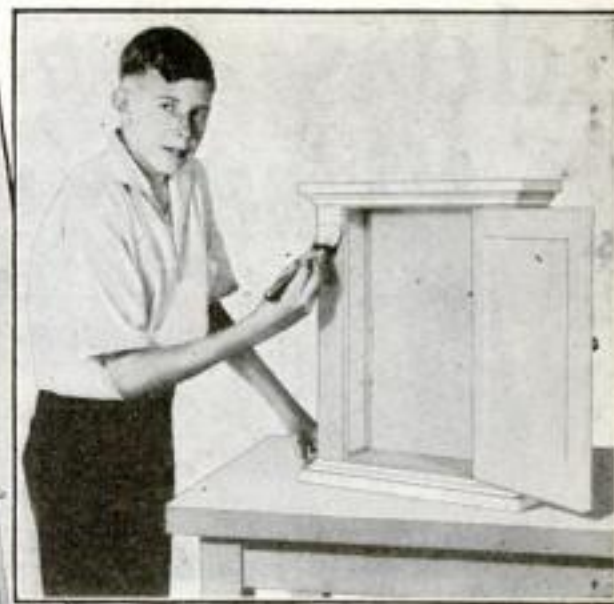
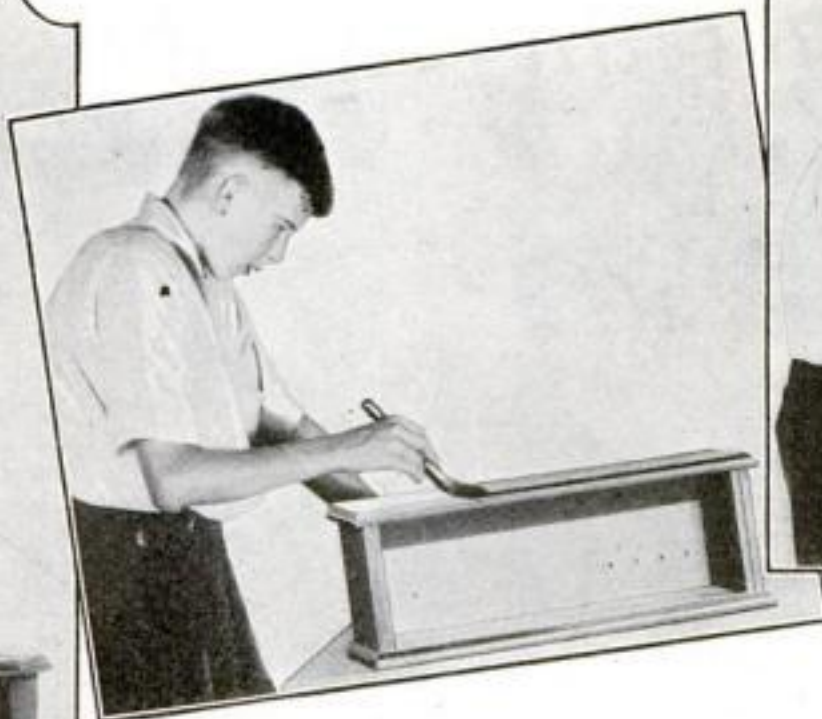
Gus flung the door open and found old man Morrison with his foot swung back, just ready to deliver another hearty kick. Morrison, who was reputed to have a purse as long as his temper was obviously short, dropped his foot to the ground and turned to shut off the ignition of his five-thousand-dollar gas buggy.

"The gosh-hanged, dad-blamed, confounded piece of junk!" he snorted apoplectically. "The blankety-blank thing stopped every time I let it slow down, and twice I had to get out and crank it to make it go again. Look her over and see what in blazes is the matter!"

"You say you had to crank it a couple of times, Mr. Morrison?"

"That's what I said!" Morrison answered testily. "And once was right in the middle of Main Street—the traffic was all balled up before I got it started."

(Continued on page 156)



The FINISH will Make or Mar Your Handicraft

*The Johnson Finishes
are RIGHT and EASY*



Stores displaying this sign carry a full line of Johnson's Artistic Wood Finishes. They will gladly give you a Free copy of the Johnson 25c Book on Wood Finishing.

IT'S the finish that counts, after all. No matter how skillfully you make home-made furniture, it takes the right kind of finishing to give that professional touch that makes you proud of your craftsmanship.

You will want the new Johnson Book on Wood Finishing. Gives complete instructions for finishing all kinds of woods—hard or soft—old or new. Tells how to stain wood artistically—everything you want to know about wood finishing. It's Free—just use the coupon below.

JOHNSON'S WOOD DYE

With Johnson's Wood Dye inexpensive soft woods such as pine, cypress, fir, birch, etc., can be finished so they are as beautiful and artistic as expensive hard woods. Comes in oil and spirit in 17 beautiful shades, among the most popular of which are:

No. 123—Dark Oak No. 129—Dark Mahogany No. 127—Brown Mahogany
No. 131—Walnut No. 126—Light Oak No. 124—Golden Oak

Johnson's Wood Dye is easy to apply. It goes on smoothly and will not rub off or smudge. Penetrates deeply, bringing out the beauty of the grain. Dries ready for the finish coat in four hours.

FREE ~ this valuable book



Get this beautiful 25c Book on Wood Finishing absolutely FREE. Contains color charts, covering capacities, and hundreds of practical suggestions for the man who wants to make his home more artistic, cheery and inviting.

S. C. JOHNSON & SON, Dept. P. S. 3, Racine, Wis.
"The Wood Finishing Authorities"
(Canadian Factory—Brantford)

Please send me Free your 25c Instruction Book on Home Beautifying and Wood Finishing.

My Dealer Is.....

My Name.....

Address.....

City and State.....

Ideas You Can Use on Your Car

These Ingenious Kinks Will Save You Time and Trouble

THE AVERAGE motorist who attempts to remove a dent in his fender usually ends up removing the paint as well. In most cases, however, it is possible to remove the dent so that it hardly shows at all and without damaging the paint, provided, of course, that the accident which caused the dent did not injure the paint.

Fig. 1 shows how to do the job. An ordinary cement sack, filled with sand, forms the support for the part to be reshaped. A wooden mallet, with a leather face under which is placed a half-pound of lead birdshot is the tool for hammering the sheet metal.

In addition, you will need a warming pad, made up of four layers of heavy felt, stitched and soaked in oil. You heat this pad on the stove, using precautions to prevent it from taking fire, and then apply it to the dent for a few minutes in order to heat the paint and make it pliable enough so that it will not crack.

IT IS bad enough to get stuck on the road with a flat tire and without a spare, but it is still worse to find that the tire pump has quit the job. Occasionally the threads that hold the barrel of the pump into the base strip out, making the pump useless.

If this happens to you on the road, a simple way to get the pump working again is to dent the lower end of pump barrel as shown in Fig. 2. The dents will force the threads out enough so that they will hold at least until the tire is pumped up.

RUSTY rims are hard on tires. The rust attracts moisture, and the moisture rots the fabric of the tire. Besides, it is sometimes very difficult to remove a tire from a rusty rim, especially if the tire has been in place long enough to allow the roughened surface to adhere tightly to the rubber.

Cleaning a rim by the ordinary method of going over the whole surface with sandpaper or emery cloth, is a long and tedious job. Fig. 3 shows an ingenious way to let the auto motor do all the work. After the tire is removed, the wheel is jacked up and the motor started and placed in gear. Screen wire nailed to a wooden handle or a piece of emery cloth or sandpaper can be held against the revolving rim until all of the rust has been removed.

CHATTERING and jerky operation is exceedingly hard on the gears, shafts and bearings of the Ford. Special oils are being sold that stop this chattering to some extent, but some of these oils have a high soap content, the effect of which is questionable as far as lubrication is concerned.

One Ford owner has solved the problem to his own satisfaction by changing the brake band lining as shown in Fig. 4. Instead of



Fig. 1—Straightening bent fender with a sand bag and mallet faced with lead shot



Fig. 2—How dents repair the stripped threads of a tire pump in emergency



Fig. 3—A quick way to clean a rim with a screen wire brush



Fig. 4—How one Ford owner prevents chattering by dividing brakeband to allow oil space

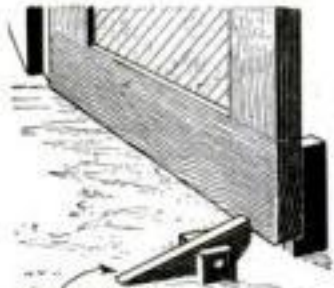


Fig. 5—A simple way to build a garage door stop and catch to make any banging an impossibility



Fig. 6—Ingenious window shade radiator cover (at right) with simple chain adjustment on dash (above)

using one complete piece, he has cut it into two parts arranged with a gap at the bottom. Extra rivet holes were drilled in the brake band so that the lower ends of the band cannot come loose.

Apparently the gap in the lining allows an extra supply of oil to flow into the rubbing surfaces and this, perhaps, is the reason for the reduction in chattering.

A PRACTICAL and useful arrangement for holding the garage door open so that the wind will not blow it shut just as you are driving out or in is shown in Fig. 5.

To construct the device, only four pieces of wood and one large nail are needed. A stake is driven into the ground at the point where you wish the door to stop when you open it, and then the wedge-shaped piece of wood is cut as shown in the illustration, and a hole is drilled slightly larger than the nail. The wedge is held in place by the nail driven through two small stakes which are driven into the ground.

The wedge and its holders should, of course, be low enough so that when the door is opened it rides over the wedge. The latter drops back into place and holds the door until you desire to release it by lifting on the point with your toe.

A SIMPLE homemade radiator shutter cover which gives perfect regulation of the flow of air through the radiator can be made from an ordinary window shade.

The construction is very simple. A window shade roller is cut down to the proper length and the catch or dog at the spring end is removed. Next a piece of auto top or curtain cloth is cut the right length and width to cover the radiator. One end of this piece is tacked to the shade roller and the other is sewn around a piece of wood which will serve to keep it straight. The roller is attached to the bottom of the radiator by means of ordinary shade roll holders or brackets riveted to the radiator shell, or a simple bent metal bracket may be made and slipped under the side of the shell as has been done in Fig. 6. The spring should be wound up fairly tight before the roller is set in the brackets.

Two flexible wires are attached to the wood strip at the top of the curtain and each wire is led through a piece of small tubing at the top of the radiator. About halfway between the radiator and the dash, these wires converge and are connected to a small chain. This in turn runs back to the instrument board and terminates in a ring. The chain passes through a metal plate prepared by drilling a small hole and filing it into a diamond-shaped opening. This arrangement holds the chain by wedging the links, thus enabling you to adjust the radiator cover.

TEN DOLLARS FOR AN IDEA!

BEGINNING with our next issue, POPULAR SCIENCE MONTHLY will award \$10 in cash in addition to regular space rates each month to the person who submits the most ingenious, novel, and useful idea for the motorist. All other published contributions will be paid for at the usual rates. What little kink have you discovered that makes your motoring more comfortable?

TRIMO pipe wrench



TRIMO

This Wrench asks no Favors in Tight Places

TRIMO PIPE WRENCHES have always been famed as big labor-saving tools — that's why American industries, mechanics, farmers and householders so overwhelmingly favor TRIMO.

The NUT GUARDS (which keep this wrench in perfect adjustment when the tool is being used in close quarters or laid down) is a wonderful time-saving feature. It enables the operator to keep steadily at his task instead of fiddling around every few minutes to adjust the jaws over the object upon which he is working.

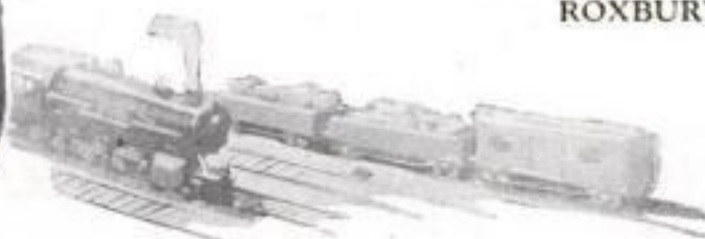
The INSERT JAW in the handle (replaceable at small cost — when worn after long service) has given TRIMO economic leadership for nearly 40 years, while its Steel Frame that will not break guarantees durability and personal safety.

This wrench is made in eight steel handle sizes, 6, 8, 10, 14, 18, 24, 36 and 48 inches; and in four wood handle sizes, 6, 8, 10 and 14 inches. The 10 inch wood handle size makes an ideal household wrench. At all hardware, mill, plumbing and oil-well supply stores. Insist on TRIMO — accept no other.

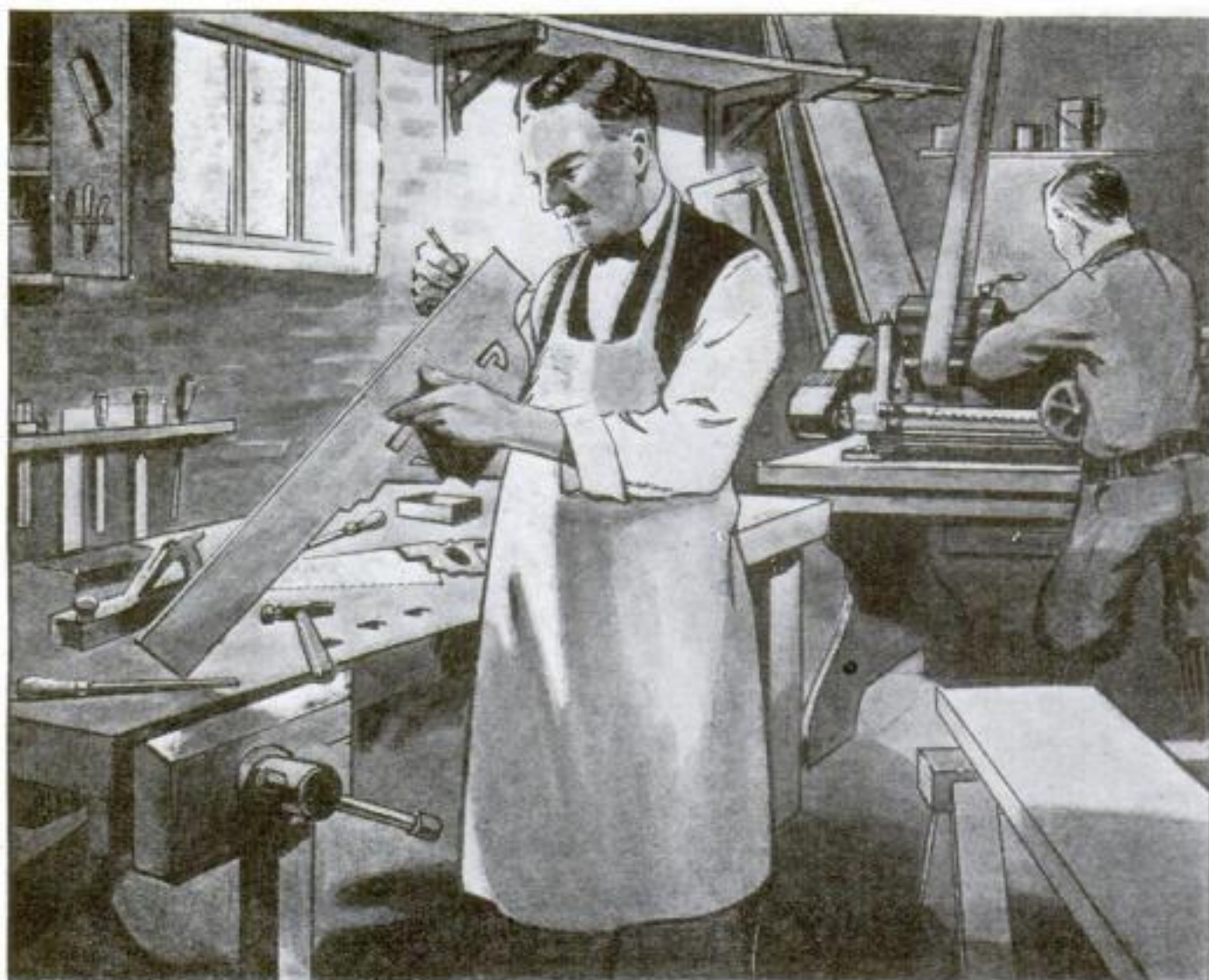
TRIMONT MFG. CO.
ROXBURY, MASS.

TRIMO Monkey Wrench

This all-steel wrench is 100% drop-forged; has no castings. It is simple, has only three parts, is practically indestructible, and the strongest by actual test. Seven standard sizes, 6 to 21 inches. Fully guaranteed.



NICHOLSON FILES ~ A FILE FOR EVERY PURPOSE



Interesting Exercise Is Always Most Healthful You Can Get It With Good Tools !

THE best of intentions never kept most of us faithfully doing our daily dozen. We must find exercise that interests the mind while building the body.

Health, pleasure and profit can be gained making and repairing things in the home workshop. Doctors and gymnasium instructors agree that working with tools is one of the best

methods of rebuilding the body by light exercise, and of providing a change from the grind of business.

NICHOLSON Files can help do countless jobs in the home repair shop that bring pleasure and health in the doing. Each NICHOLSON File comes to you rigidly tested, and is standard file value for keenness, uniformity and durability.



NICHOLSON FILE COMPANY
PROVIDENCE, R. I., U. S. A.



At all good hardware dealers



The Home Workshop

Arthur Wakeling, Editor

Furniture Refinishing Made Easy

An Expert Reveals the Secrets You Need to Know when Restoring Antiques

BY RALPH G. WARING

Specialist in Furniture and Auto Finishes

DAN, one of the apprentices, came eagerly into the laboratory to see me the other day.

"Mother has some old, worn pieces of furniture that have been in our family a long time," he began. "I would like very much to fix them up for her and the men told me to come in and ask you about it, Mr. Waring. Will you show me just how to refinish them correctly?"

"To be sure I will, Dan," I said. "You come around at twelve-thirty each day and I will give you part of my noon hour until you can go it alone. How will that do?"

"Fine, sir! I certainly will be here. And Jim said he would get the pieces when he went out with the truck."

Sure enough, when 12:30 blew, Dan came in, smiling all over. He had a really fine mirror under his arm and was followed by Jim with a small cherry table. The mirror had a frame with rosewood outband and crotch mahogany face.

"Take your finger and tap every part of the surface like this," I told him, "and if you hear a tiny snapping sound, then the veneer is loose and must be repaired."

Mr. Waring, a consulting chemical engineer, shows Dan how to do staining. This method of holding a brush allows free finger and wrist motion

Now take out the mirror and store it in that cupboard."

"Don't you take off the old finish first, Mr. Waring?"

"No, Dan, for then the remover would get down beneath the veneer and make a lot of trouble with our glue work. Then, too, if we get any glue on the old varnish, it will not matter. Saves time, you see."



"We shall patch up the loose pieces first. The glue must be hot and thick enough so that when you put your thumb and first finger into the pot and take them out, the glue will stretch at least $\frac{1}{4}$ in. as you spread finger and thumb slowly apart."

A small piece of tin was used to push the glue under the veneer. The spot then was covered with tin, backed up with a block and well clamped.

"How about curved places?" asked Dan as he indicated another loose place.

"IN THE factory the men use blocks shaped to the same curve, Dan, but we shall take one of these small cloth sacks we use for mailing and fill it nearly full of salt or sand. Now, if the veneer won't lift at that spot, hold a sponge damp with hot water on it or take a piece of wet felt and a hot iron to steam it. That loosens and softens the veneer so that it can be lifted and the glue pushed under. Put a piece of tin over it, lay on the bag, put a block over that, and then clamp so as to force the bag to take the shape of the curve. Let those places set for an hour, then take off the clamps and tin in order that the glue may harden properly overnight."

Dan made a good job of cutting and fitting new veneer stock where the original veneer was missing. If it had been necessary to put 5 or 6 in. of new outband, the veneer strips would have had to be tacked on a board and a piece of paper glued across. This would hold the pieces together so that they could be clamped more easily into place on the band molding.

(Continued on page 104)

Gluing loose veneer and clamping on patches (below). Sand bags are used where necessary to force the veneer against curved or molded surfaces



Cutting a veneer patch (above). The knife is a scraper blade set in a handle. Fine saw teeth are filed in the thin, beveled cutting edge. The flat face of the knife is held against the try-square. Note the veneer strips tacked down so that they can be joined with a small strip of paper glued on. In a furniture factory gummed tape like that made for wrapping is used for joining veneers



Just *What* Tools Do You Need?

*Four Ideal Assortments for the Home Workshop
Are Chosen by a Jury of Expert Craftsmen*



GOOD tools delight the heart of every man. To own them gives keen satisfaction, and to put them to work is for the amateur mechanic a fascinating and profitable pastime.

In these days of high costs, no household can afford to be without a chest or cabinet well filled with tools. They are essential even if they are made use of only in the small repair jobs that constantly require attention in every home.

"What tools do I need?" is, therefore, a question of immediate and vital interest. Too often one sees a well intentioned home owner painfully and laboriously trying to cut 4 by 4-in. rough chestnut posts for a grape arbor with a fine 18-in. crosscut saw, the teeth of which have little or no "set." The saw may be a costly and splendid tool, designed for the finest cabinet work, but it sticks, binds, and buckles when driven by main strength through green timbers.

Conversely, another amateur mechanic, in undertaking the construction of a bookcase or kitchen cabinet, will attempt to cut up the stock with a large, coarse saw, the teeth of which have been set widely so as to hew their way through rough and heavy boards.

It is possible that an expert carpenter could cut the heavy posts with a fine saw without seriously damaging it or wearing out his strength, and that he could make reasonably straight and square cuts through expensive finishing lumber with a coarse, heavy saw intended for rough work, but the amateur mechanic cannot do so. It is futile for him to try. He must not only have good tools, but also the right tools for the work in hand.

As the question of what

tools to buy comes repeatedly from readers to the Home Workshop Editor in all sorts of guises and variations, it was decided to organize a committee or jury of six specialists in this field for the purpose of working out ideal tool assortments for the home workshop.

Whether you wish to purchase a new outfit or to add to the tools you already own, you will find that the following lists will be most helpful. They represent the consensus of

opinion of men who have made notable contributions to the Home Workshop Department in the past, and all of whom are acknowledged authorities:

William J. Edmonds, Jr., a craftsman and contributor of many woodworking articles to POPULAR SCIENCE MONTHLY.

Emanuel E. Ericson, Head of the Department of Vocational Education and Community Mechanics, State Teachers College, Santa Barbara, Calif., noted manual training authority and contributor of the series on woodworking methods that has been running for many months in the Home Workshop Department.

Edwin M. Love, craftsman and specialist in woodworking methods, author of the attic room series now being pub-

lished in this magazine, and a very well known writer on furniture making.

Albert S. Peacock, of the Department of Mechanical Engineering, New York University, who wrote the article, "Your Tools and Their Care," in the September, 1924, issue.

F. E. Tustison, Head of the Department of Science and Home Mechanics of Stout Institute, Menomonie, Wis., author of several standard sets of job sheets in home mechanics and woodworking that are used very widely in schools throughout the country, and contributor to the Home Workshop.

William T. Weld, Shopwork Instructor, Central High School, Peoria, Ill., and contributor to this magazine, as well as to various manual training magazines.

The first question put before this jury was:

What is the best small assortment of tools for doing repair jobs about the house and garden and for simple woodworking—a typical handyman's set that no household should be without? Four or more votes were cast for each of the following tools:

Household Tool Assortment

Nail (or claw) hammer, bell face preferred
Crosscut (or hand) saw, 24 in. or 26 in.
Carpenter's chisel, socket firmer, bevel edge, 1 in.
Bit brace, 8-in. sweep, ratchet preferred
Auger bits, $\frac{1}{2}$ and $\frac{3}{4}$ in.
Bit-stock drills for metal, $\frac{1}{8}$ and $\frac{1}{4}$ in. (Useful also for wood)
Screwdrivers, 4 in. and 8 or 10 in.
Combination pliers, 6 or 8 in.
Files—saw file, 6 or 7 in.; flat or mill bastard, 8, 10, or 12 in.; auger bit file
Jack plane
Try-square, 6 or 8 in.
Steel (framing) square
Monkey wrench, 10 in.
Miter box, wooden
Wrecking bar, small
Oilstone, artificial, combination
Nail set, $\frac{1}{8}$ in.
Oil can
Half hatchet
Cold chisel, $\frac{1}{4}$ in.
Putty knife

The Jury of Tool Experts



William T. Weld



Emanuel E. Ericson



F. E. Tustison



Albert S. Peacock



Edwin M. Love



William J. Edmonds, Jr.

Several of the jurymen wished additional tools incorporated in this assortment. Three of them thought a rip saw necessary, but disagreed as to the size, one voting for a 22-in. rip saw, another for a 24-in., and a third for a 26-in. The remaining jurymen, however, felt that whatever ripping had to be done in connection with the average small repair job could be accomplished satisfactorily with a 24- or 26-in. crosscut saw, provided it was sharpened for general work and was not finer than 8 points to the inch.

Three of the jurymen desired to include a $\frac{1}{2}$ -in. chisel, and two of them thought both $\frac{1}{4}$ - and $\frac{3}{8}$ -in. chisels also were necessary.

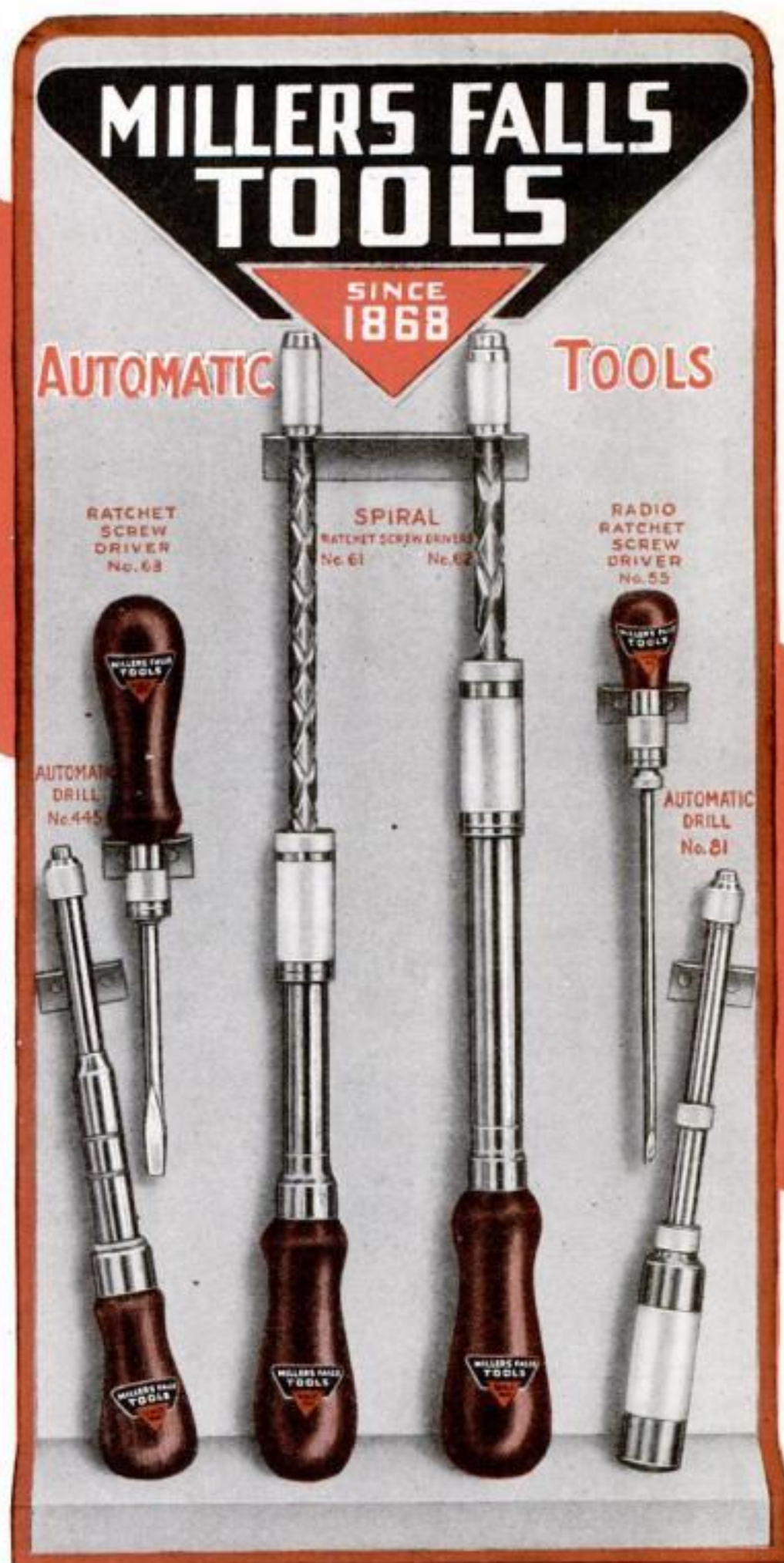
(Continued on page 88)



Look
them over
—try them

The display shows
six of our popular
Automatic Tools

*Read more about them
at the bottom of the page*



THERE is real satisfaction in using good tools. These Millers Falls Automatic Tools, for instance—they'll work with you for years and years and never let you down.

Do you want to know them—or know them better? Then look for this display in your hardware store. It makes it easy for you to inspect them—"heft" them. They will give you a good idea of the finish, design and working qualities that have built Millers Falls reputation for the kind of tools good workmen prefer.

28 Warren St.
NEW YORK

MILLERS FALLS COMPANY
MILLERS FALLS, MASS.

9 So. Clinton St.
CHICAGO

**Automatic Drill
No. 445**

A NEW and popular member of our family of five automatic drills. Reliable, handy, low in price.

**Ratchet Screw Driver
No. 63**

COMPACT, strong—quick, convenient and easy to use. Every tool user will find one of these helpful.

Spiral Ratchet Screw Driver No. 61

EVERYTHING in one screw driver—about the finest tool you can own. Three actions—spiral, ratchet, rigid.

Spiral Ratchet Screw Driver No. 62

THIS is No. 61's big brother—longer, heavier, stronger. Three blades furnished with each spiral screw driver

Radio Ratchet Screw Driver No. 55

FOR radio and other light work with small screws. Knurled collar makes starting screws easy.

Automatic Drill No. 81

OUR finest drill. "Likes hard wood as well as soft." Drill points easily accessible.

How to Make Your Own Screens

A Woodworker Shows You an Easy Method of Putting Together the Frames—The Trick of Stretching Wire Cloth Tightly

By EMANUEL E. ERICSON, *Noted Manual Training Authority*



Fig. 1. If you rip up your own screen stock from wide boards, each piece must be planed on the edges



Fig. 2. Marking an end joint on two stiles (long members) at once



Fig. 3. A marking gage is used to complete laying out each joint



Fig. 4. Using a crosscut saw to make the first cut in a pair of stiles clamped together in a vise. The cut surfaces can be trimmed with a chisel later if necessary

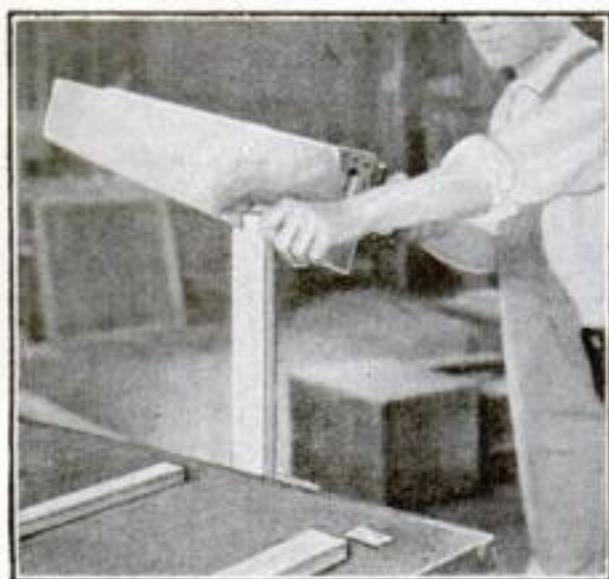


Fig. 5 (above). Making the second cuts with a rip saw. Fig. 6 (center). Nail the joints well with eightpenny finishing nails

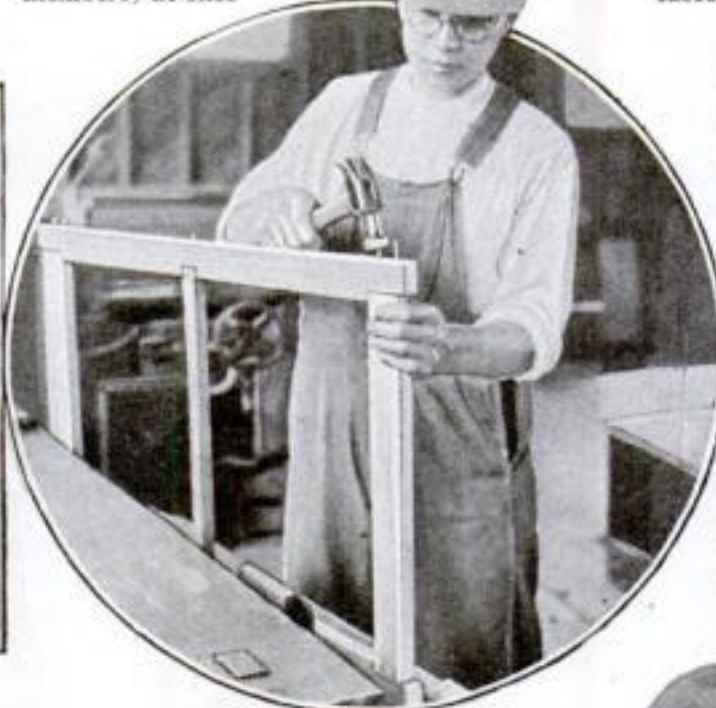


Fig. 7. After being assembled, the frame is smoothed with a plane and then thoroughly sandpapered

SCREEN windows and doors for the home can be made easily by any one who possesses a few woodworking tools and a workbench.

The most convenient way to obtain material for screen windows is to buy it from the lumber yard or mill already cut to the required size. White pine, sugar pine, or Oregon pine are suitable woods. The strips should not be lighter than 1 by 2 in. (these actually measure $\frac{3}{4}$ by $1\frac{1}{4}$ in.) for the side and top pieces, and $2\frac{1}{2}$ -in. material for the bottom. The middle bar may be narrower, but not less than 1 in. If the outside casings of the windows are $1\frac{1}{8}$ in. thick, lumber of the same thickness ought to be



Fig. 8 (above). Tacking one end of the wire cloth to a strip nailed to the bench. Fig. 9 (at right). The netting then is tacked to the far end of the frame, which is raised on a strip of wood

used for constructing the screen frames. If this material cannot be obtained readily, it is a simple matter to rip the pieces from planed boards of any width. When cutting the pieces roughly to

width at the mill, very little planing needs to be done.

One of the most important parts of the job is the laying out. It is best for the

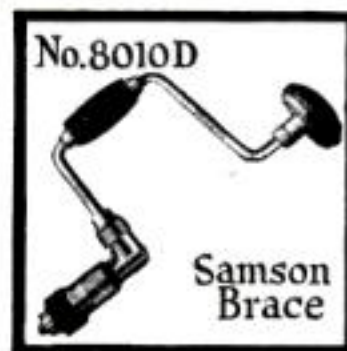
(Continued on page 94)

TURN TO PAGE 78 FOR THE CONTINUATION OF THE HOME WORKSHOP DEPARTMENT



In order to work successfully at a mechanical trade or to take pleasure in making things at home you need good tools, tools that will stand up and do the work required of them.

The Peck, Stow & Wilcox Co. has been making good tools for more than 100 years. These tools, formerly branded P. S. & W. Co., now branded PEXTO, are of the highest quality and are **FULLY GUARANTEED** as to workmanship and materials.



The line consists of Bit Braces, Auger Bits, Squares, Chisels, Hammers, Hatchets, Pliers, Monkey and Pipe Wrenches, Angle Wrenches, Screw Drivers, Snips, Compasses, Pruning Shears, Dividers, Calipers, Pincers, Soldering Coppers, and many other small tools.



Booklets covering our important lines are available for free distribution

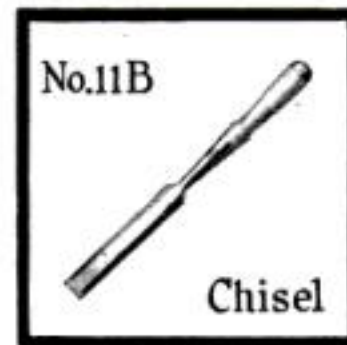


PEXTO TOOLS are carried by practically all progressive dealers.

THE PECK, STOW & WILCOX CO.
SOUTHINGTON, CONN., U. S. A.



*Worth
While
Tools*



Better Shop Methods

How Expert Mechanics Save Time and Labor



Old Bill Talks on Cutting Fluids

Are They Really Lubricants or Just Cooling Agents?—Hints on How to Choose the Most Efficient Cutting Oils and Compounds

BY H. L. WHEELER

Machine-Shop Foreman

WHILE a cold March rain beat drearily against the shop's saw-tooth roof and coursed in silvery streams down the expansive windows, Old Bill's men leisurely consumed their lunches and chatted about the prospects of getting their baseball team out for a little practice when the yard, which was now a morass from thaws and downpours, had dried sufficiently to allow them to spend their noon hours outside. But baseball seemed still too remote for much enthusiasm and their conversation drifted into shop talk.

"Let me tell you this—" Harvey Lewis was saying. "Not one of you, I'll bet, can explain the action of cutting oils and compounds. We all know that by using a certain fluid with this or that operation, we'll get certain results. But why?"

"They are just lubricants," some one volunteered.

"Go on!" retorted Lewis. "That's what I thought you would say. In fact, it's what the handbooks and the manufacturers of cutting compounds tell us, but I could never see it. Where does the lubrication come in?"

"Oh, they also tell us that the oil cools the tools and the work, as well as lubricates them," put in Joe Keats.

"Yes, it cools—and nothing else," said Harvey. "Then why call it a lubricant?"

Old Bill, nursing his pipe, and with his right thumb hooked in the shoulder strap of his overalls, had come up to the group.

"WELL, Harvey, if you have been studying up this proposition, let's hear why you have come to that conclusion," suggested Old Bill, who was always anxious to draw out his men. "One would think that the people who handle and sell these products ought to know more about them than we do, and you said yourself that most of them refer to oils and compounds as cutting lubricants. I have always thought they both cooled and lubricated."

"A cutting oil or compound," Harvey replied, "is primarily intended as a cooling medium to carry away the heat generated by the friction of the tools in cutting the work."

"What about hand taps and threading dies?" inquired Keats. "They are seldom worked fast enough to cause any heat. How do you account for the action of oil in their case? If oil has only a cooling function, we might as well not use it for tapping and threading."

The boys thought Harvey was cornered, but he had another argument left.

"But how do you explain the fact," he demanded, "that the poorest lubricating oils make the best cutting oils and that

A blast from the shop's whistle put an end to the discussion, but it had lasted long enough to give the machinists an inkling of how much there still remains to be done before shop practice in regard to the use of cutting oils and compounds can be standardized.

Opinions vary on the merits and demerits of the many different oils and compounds. There is no universal rule in their application. Each shop finds by experiment or custom what is best suited for its particular purposes. Only in a few instances is there any general agreement that one oil or compound is best for a given operation. Hand tapping and threading may be cited as one example; for this class of work pure lard oil is favored.

Before the days of high speed, quantity production, little was thought about the subject at all. The necessity of using oils or other cooling mediums was not considered vital. In early machine-shop practice most metal working was done dry with slow speeds and feeds.

Gradually water came into use and then followed the various oils—animal, vegetable, and mineral. With the expansion of industry came a demand for cheaper substitutes, which resulted in the use of the many different soaps and

alkali compounds with which we are familiar today. Some of these are patented.

For certain kinds of work pure lard oil has no equal, but, owing to its high cost, it has been found expedient to dilute it with cheaper oils and soap compounds. And through this practice have been developed many valuable formulas.

A COMMERCIAL product known as a mineral lard oil is regarded as one of the best substitutes for pure lard oil. The quality of mineral lard oil, however, varies greatly and the name alone seldom conveys any definite idea of the quality.

A common objection found in many oils and compounds is their tendency to create sores, boils, and ulcers on the hands. If a man has a cut, there is danger even of

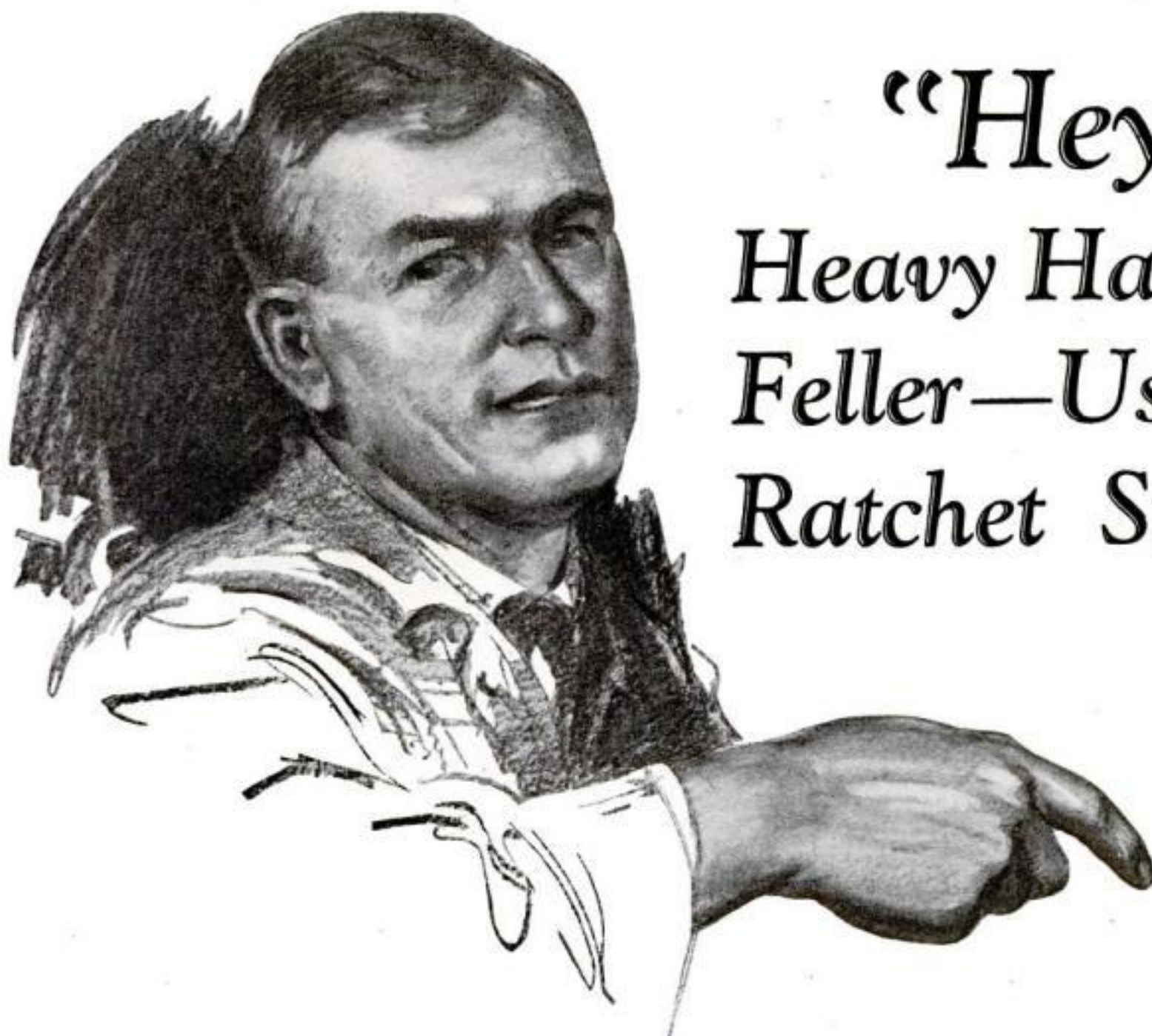
(Continued on page 128)



Joe Keats cited hand taps and dies to prove that our cutting fluids are lubricants rather than coolants

the best quality of lubricating oils do not give satisfactory results when used as cutting oils? I have tried out pretty nearly every kind of oil and have found this to be true."

"That may be true," admitted Old Bill; "but it is rather a description of what we have found out through experiment than an explanation of the cause. Perhaps we can't go much farther than simply to say that the use of oils and compounds is helpful. Cutting tools generate heat and the oil or compound keeps the tool and the work cool, and that allows us to remove more metal in a given time. The fluid insures a longer tool life, besides making possible increased production. It washes away the chips and allows a better and more accurate finish. In these ways it speeds up the work and reduces the cost of machining."



**"Hey!
Heavy Handed
Feller—Use the
Ratchet Stop!"**

"You'll do better, more accurate work and y'won't be springing that mike I just lent you!"

A Ratchet Stop does help the man whose "feel" is not supersensitive and it helps *any* man to do quicker, accurate work because it relieves him of the necessity of always guarding against springing his mike by jamming the spindle against the work.

That's one reason why a lot of men like the Starrett

No. 230—it has a Ratchet Stop. Another, bigger, reason is the cut-away frame. You can get it into lots of places where an ordinary frame can't be inserted.

Ask your dealer to show you this tool. Write us for descriptive matter and Catalog No. 23 "W."



THE L. S. STARRETT CO.

*World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
Steel Tapes—Standard for Accuracy
ATHOL, MASS.*



8805

Use Starrett Tools



While hand holds driver steady, you start screw with thumb-turn on blade.

Starting small wobbly screws is easy with a "YANKEE" No. 15 Ratchet Screw-driver

Not only easy, but fast. With thumb and forefinger you revolve knurled washer on blade and quickly start the pesky little screw.

After starting with thumb-turn, you send screw home by ratchet movement.

No. 15 (Illustrated) comes with 2, 3, 4, 5, 6, and 8 inch blades.

One grip on the handle is all that is needed. Then turn to and fro, and the smooth "Yankee" Ratchet does the rest. Right and left ratchet; and rigid.

No. 10 Comes with 2, 3, 4, 5, 6, 8, 10, and 12 in. blades.
No. 11 Same as No. 10, except that Ratchet Shifter moves across instead of parallel with blade.

Some Other "Yankee" Tools

Plain and Spiral Screw-drivers;
Ratchet Bit Braces
Ratchet Hand Drills
Automatic Feed Bench Drills
Ratchet Tap Wrenches
Vises, Removable Base

Dealers everywhere sell "YANKEE" TOOLS

"Yankee" on the tool you buy means the utmost in quality, efficiency and durability.

Write for FREE "Yankee" Tool Book.

NORTH BROS. MFG. CO., Philadelphia, U. S. A.

"YANKEE" TOOLS

Make Better Mechanics

The Home Workshop

Few Tools Used to Carve Chest

WOODWORKERS

By E. M. COOK

of limited experience are timid about attempting wood carving. They think it requires long training and special aptitude. In reality, any one who wishes to do this kind of work need not hesitate a moment. The only skill required is a steady hand, together with patience and an eye for symmetrical design. An illustration of what can be done is the chest shown, which was carved by the writer when he was 16 years old.

My mother had expressed a wish several times for a cedar chest, so I made one of gumwood lined with cedar and started to carve it with nothing but ordinary woodworking chisels and a skew

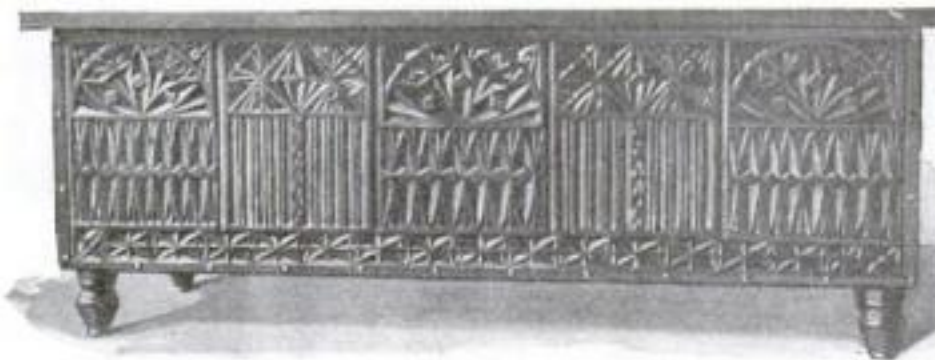
section and carried toward the edge, only a small shaving being taken each time.

In carving, the last cut made by the chisel is the finished surface; sandpaper is not used. It is no detriment to have the chisel marks show; in fact, it is considered a desirable characteristic in carved work.

The gumwood exterior was stained a dark brown in this instance and oiled with several coats of a mixture of half turpen-



Front and top of a gumwood chest, lined with cedar, which was constructed by Mr. Cook when he was 16 years old. It was his first attempt at carving. He believes that the difficulty of carving is overestimated by most woodworkers



chisel ground from a 1/2-in. file. My father, having seen what I was doing, gave me a set of carving tools and I continued to work at odd times for the greater part of a year. When finished, the chest was entered at a state fair and drew first prize in the advanced class. Our city school supervisor saw it and as a result he encouraged me to continue studying manual training until I finally became a teacher of that subject in the Des Moines, Ia., high schools.

In this instance the design was made up as the work progressed, only the main spaces being blocked out at first. The work was started from the center of each

tine and half boiled oil, to be applied hot.

While a set of half a dozen or more carving tools is desirable, the work can be done with a skew chisel about 1/2 in. wide and a parting tool to start the center of each cut. It is essential that the tools be kept sharp. This is done by honing them on a fine oilstone or slip and stropping them on a piece of emery-covered leather.

If this type of work appeals to you, you will find it becomes constantly more fascinating as you go along, as is indicated by the fact that the writer made three more chests after completing the one illustrated, as well as many other carved articles.

Elaborate Radio Cabinet Costs Less than \$20

ELLIE CRASS, of Paducah, Ky., who built the upright radio cabinet illustrated, was encouraged to undertake this elaborate piece of work by an article that appeared in the Home Workshop Department in February, 1923. He writes:

"To build an ideal radio cabinet is neither difficult nor expensive if the details shown in POPULAR SCIENCE MONTHLY's Blueprint No. 16 or the article that appeared in the February, 1923, issue are followed.

"In building the cabinet



Built by Mr. E. Crass, resident of Paducah, Ky.

shown, I used No. 1 seasoned oak for the framework, at a cost of \$8. The side panels were given to me by a friend. Front doors and scrollwork were made at a lumber mill at a cost of \$5. The cost should not exceed \$15 or \$20, and if cheaper lumber is used, it can be built for less."

There are two radio cabinet blueprints in the Home Workshop series (see page 86). One is a large and elaborate inlaid cabinet (Blueprint No. 16) and the other is a greatly simplified cabinet resembling a Spanish desk (No. 35).



LESS than carfare or busfare, far less than automobile cost—riding the new Harley-Davidson Single is the most economical means of comfortable travel.

Wholly a new type of machine. Travels 80 miles on every gallon of "gas"—ample power and speed for all road and traffic conditions—above all, a safe, sensible, comfortable mount for everyday use by everybody.

Easy to ride—practically self-balancing. You'll master it in the length of a city block. Ride it to work and back—on errands—for pleasure on evenings and Sundays—and save money every mile!

Ask your Harley-Davidson Dealer for a demonstration. Mail coupon for illustrated literature.

HARLEY-DAVIDSON MOTOR COMPANY, MILWAUKEE, WISCONSIN

The New
HARLEY-DAVIDSON
Single
[The New-Type Motorcycle]

Safe—Comfortable

Perfect balance and a low center of gravity provide maximum safety at any speed. Luxurious springs in fork and seat post smooth out the roughest roads. Low saddle position adds to riding comfort and ease of handling. Balloon tires and broad footboards add the finishing touches to comfortable riding.

Park It Anywhere

Ride right up to your destination—and park there. Any 2x8 space will house your Single—in a hallway, on the porch, in a garage corner—anywhere. No parking troubles in even the most congested centers.

Easy To Buy

The Single is low in price. If you prefer to pay for it out of your income, your dealer has a convenient Pay-As-You-Ride Plan that he'll gladly explain to you.

Note: Rich sales opportunities now in the motorcycle business. Write for proposition.

*Mail
this
Coupon*

HARLEY-DAVIDSON
MOTOR CO.
Dept. P.S.
Milwaukee, Wis.

() Send free literature describing the "New Single"
() I'd like to sell the New Single. Particulars, please.

Name.....

Address.....

City..... State.....

Makes Machines Fill the Order

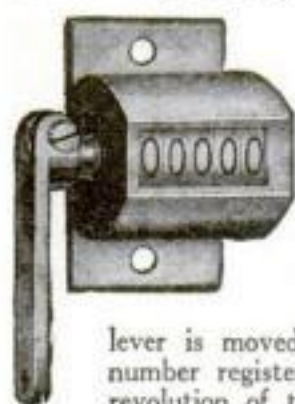
You devise a machine for a definite job; that's why it does the job.

You give the operator a definite task. That's why he makes good the task.

What must be done is done, when it must be recorded. Whatever the order—in terms of production—it's filled when it has to register on a

Veeder COUNTER

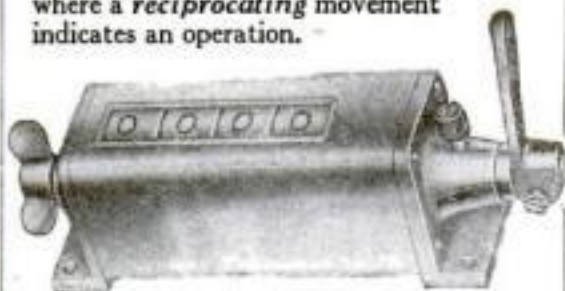
This small Rotary Ratchet Counter (No. 6) counts reciprocating movements of the lever, as required for recording



the output of innumerable small machines. When the lever is moved through an angle of 40 to 60 degrees, the counter registers one. The further the

lever is moved, the higher the number registered. A complete revolution of the lever registers ten. This counter can be adapted to no end of counting purposes, by regulating the throw of the lever. Price \$2.00. (Cut nearly full size.) Small Revolution Counter, also \$2.00.

The Set-Back Rotary Ratchet Counter below is for machines such as presses and metal-stamping machines where a reciprocating movement indicates an operation.



Registers one for each throw of the lever and sets back to zero from any figure by turning knob once round. Supplied with from four to ten figure-wheels, as required. Price with four figures, as illustrated, \$11.50 subject to discount. (Cut less than 1/2 size.) Set-back Revolution Counter of similar model, \$10.00 (list).

Write us about that counting problem of yours—or see how it's solved in the Veeder booklet; copy free.

The Veeder Mfg. Co.
44 Sargeant St., Hartford, Conn.

The Home Workshop

A Ship Model of Your Own

How to Make the Masts, Sails, Guns, and Other Accessories—The Concluding Article

By CAPTAIN E. ARMITAGE McCANN

OUR Barbary pirate ship model now is beginning to take shape. We have cut out and assembled the hull, deck, bulwarks, and stern-board as described in the February issue of POPULAR SCIENCE MONTHLY and are ready to get to work on the masts, sails, flags, and accessories—all the fascinating little details that will give our model real distinction and enduring value.

Do not forget that you will make your work much easier by obtaining Home Workshop blueprints Nos. 44 and 45 (see page 86), as they contain full size drawings of all the important parts.

The masts are made from 1/4-in. dowel sticks, tapered to about half that thickness at the top. The mainmast is 10 in. and the foremast 7 1/2 in. long, measuring from the deck; they project into the hull about 3/4 in. The foremast should be a bit thinner than the main. Both rake forward a bit, especially the foremast.

Cut a slight groove around them about 3/16 in. from the top to keep the rigging from slipping. The knobs at the top, which are called trucks, can be beads or small button molds, or may be whittled from soft wood.

The yards to which the sails are fastened invariably were in two or more pieces lashed to-

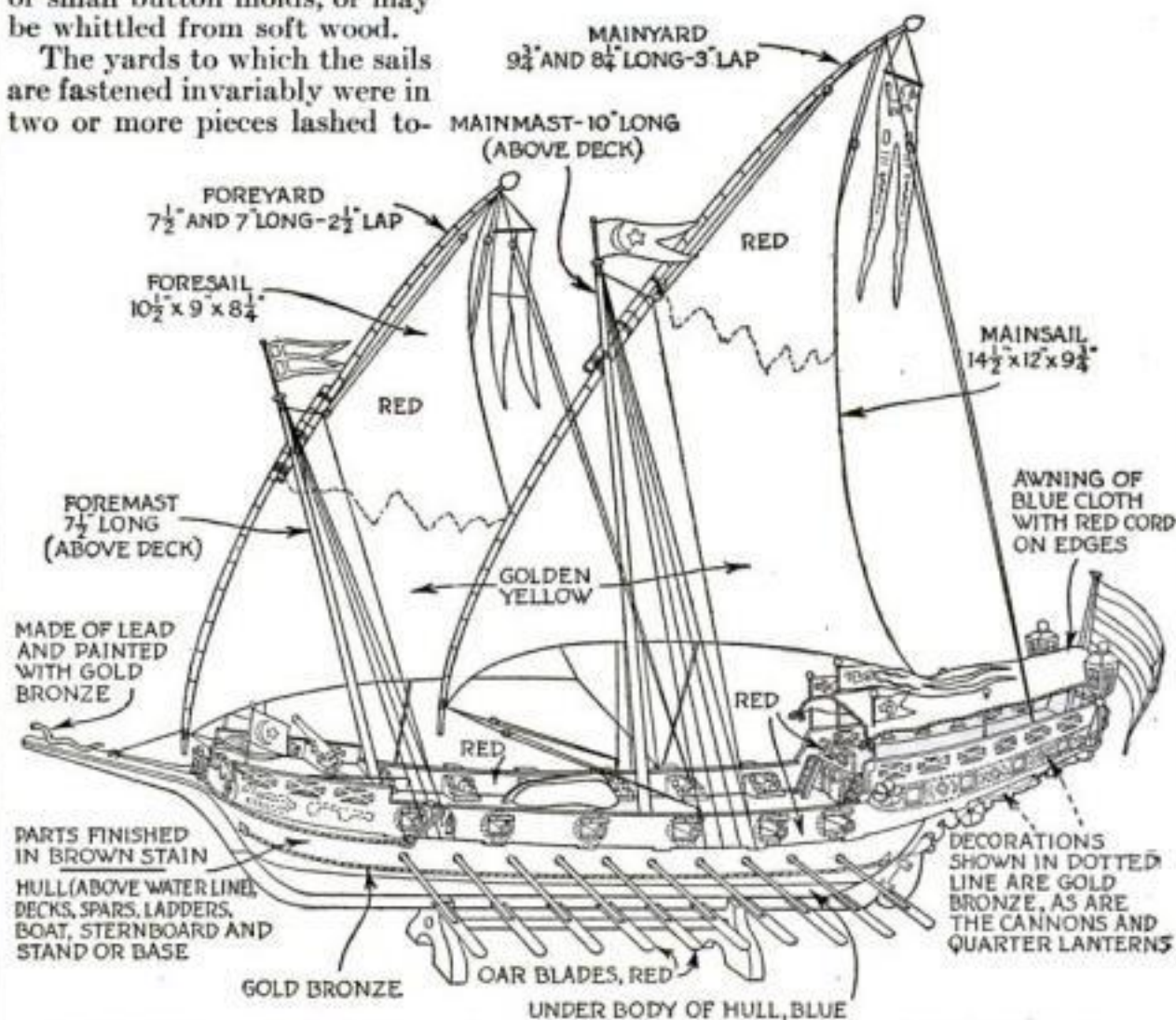


Full size drawings of the parts of this picturesque galley are to be found in Home Workshop blueprints 44 and 45

gether at the thicker ends. On our model they are 3/16-in. dowel sticks. They should be boiled in water for a few minutes and held in position until cool by means of a few nails driven in a board. They have round knobs on the upper ends. Yards and masts look most natural if stained a light walnut or dark oak color.

The sails may be silk or linen. Mine are of an unevenly woven light, dull yellow silk (natural colored pongee) with the peaks "dipped in blood," that is, turkey

(Continued on page 110)



What lifts this rakish pirate felucca above the ordinary ship model is as much its brilliant color as its striking lines. How to paint the ship is indicated here; the colors of the flag are shown on page 112

*I wouldn't
ask for
a better
hammer.*



®

And if I did, I couldn't get it. There's 90 years of practical experience in hammer making and some almighty good material put into every Cheney Hammer.

You'll notice some of the difference as soon as you pick a Cheney up—but you won't get the full meaning of it until you have swung it for a full day.

There's the grip that seems to mold itself to your hand and relieve the strain on the fingers and forearm. There's balance

—and no other hammer hangs quite like a Cheney. There's weight where weight belongs, a head that will neither batter nor chip and claws that grip and grip when you put a strain on the handle.

For real hammer value, ask for Cheney.



For an all-purpose vise
ask your dealer to show you
the PRENTISS.





Homeworker's handiest tool

MEN who are handy with tools, save themselves a lot of money by making useful household articles during their spare evenings. And they get the craftsman's satisfaction of making things skillfully with their own hands—a pleasure which the age of automatic machines and mass production has largely taken away. But LePage's, as the handiest tool in your workshop, helps to give these pleasures back to thousands.

Perhaps you have never thought of the special advantages of using LePage's Liquid Glue. It is always ready for immediate use. No weighing, soaking or heating is required. Its quality is always the same. It "sets" slowly enough so that you have plenty of time to place the joints together exactly as they should go. Slow setting also allows LePage's to penetrate the wood, increasing the strength of the joint. LePage's Liquid Glue is equal in strength to any animal glue. Buy a can for your workshop. It is the easiest, quickest, handiest form of Glue. Insist on LePage's.

RUSSIA CEMENT COMPANY

Laboratory and Factory

260 Essex Ave., Gloucester, Mass.

LEPAGE'S
GLUE
Bottles, Tubes, Cans

The Home Workshop

How to Make a Wooden Seesaw that Children Cannot Break

By MORRIS A. HALL, M.E.

MANY a man has labored long and diligently to make a toy or plaything for his child or children, only to have it practically destroyed or at least rendered useless within a few days. Children are so rough, consciously or unconsciously, that anything built for them and intended to last must be extraordinarily durable.

The writer constructed for his child a seesaw that has been the source of so much pleasure and amusement that he is glad to have the opportunity of passing along the plans. After six years' use, nearly seven in fact, the time is approaching when the child will have outgrown this toy. It is in such good shape that it can be passed along to another smaller child, who can use it for years to come.

All it will need is an additional coat of varnish or paint.

The seesaw requires only six pieces of wood and can be constructed in a comparatively short time. It consists, roughly speaking, of a 10-in. board mounted on a pair of side members, which constitute the rockers. These are set out at an angle, or flared, to give additional stability. The ends of the boards are rounded into seat form, while a notch on either side for the legs or knees and a handle at each end give the children using it adequate means of holding on, no matter how violently it is rocked.

The long board must be selected with care. It should be straight grained, perfectly flat, well dried, and free from knots or holes. That which the writer selected, as the drawing shows, was a bit



The seesaw after six years' use

narrower than 10 in. wide and when the edges were planed was but $9\frac{3}{4}$ in. However, any width up to 12 in. and down to 8 in. could be used. This board happened to be 78 in.

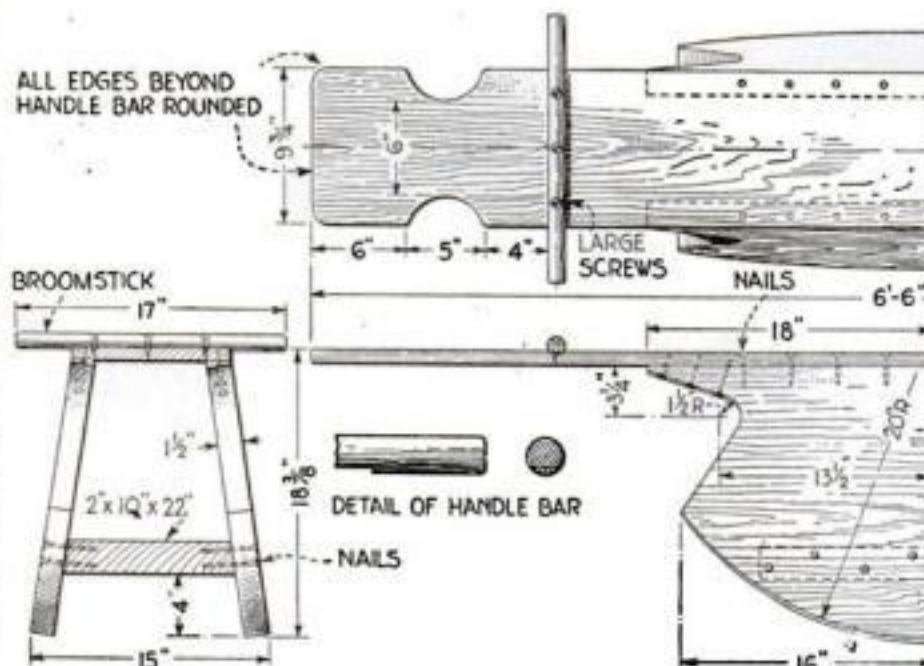
long. Any length from 75 to 80 could be used, and by altering the radius of the rockers to suit, even longer or shorter boards would serve the purpose successfully.

The seesaw will take small children's feet about 10 in. off the ground and that is about as high as most small children care to go, so it represents a fair average and a most useful size.

The side members or rockers were cut from two heavy boards of $1\frac{1}{2}$ -in. lumber, planed on both sides. These were 18 by 36 in. originally. They were marked with the aid of a cardboard pattern and cut to the correct shape. The angle at which they are set was obtained by planing off one edge of the upper surface before the top board was attached. These parts were put together very rigidly with large nails, except at the extreme ends, where long, slender screws were used.

When the rockers had been attached, a block made from a piece of 2 by 10 in. rough lumber was inserted as near the bottom as practicable and securely nailed. It was made comparatively short, so that in a casual glance at the completed seesaw, one does not see it.

The ends of the top board were shaped partly by trial, and the handles were located in a similar manner. The latter consist of



Half the top and side views of the seesaw, the end elevation, and a detail of the sturdy broomstick handle-bars



Maydole Hammers



The machinist



The plumber

For men who want the finest hammer

There's one hammer that has been the outstanding favorite of tool users for more than three generations.

THE MAYDOLE HAMMER

Pick up a Maydole. Get the feel of it. Its "hang" is different from and superior to that of ordinary hammers. The head is **press-forged** of tool steel, tempered separately at each end. The handle is of selected, second-growth hickory that has been air-dried for years.



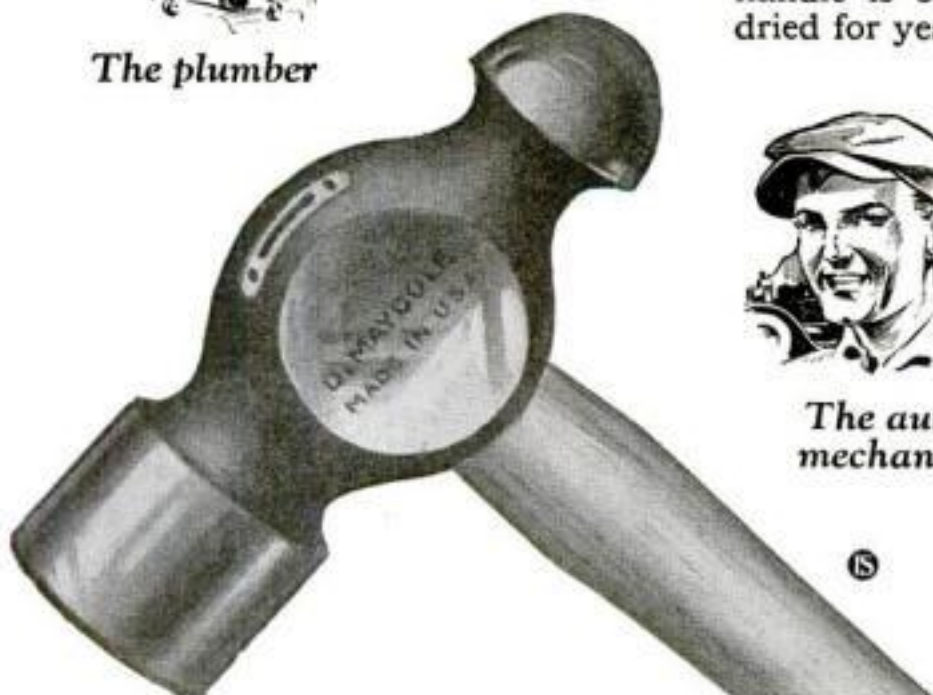
The auto mechanic

The Maydole Hammer has no "patent" wedges to keep the head tight. It's **made** tight and it **stays** tight. There is no stain on the handle to cover up imperfections. It's all hammer—the finest that 83 years of accumulated skill and experience can produce.

Your dealer sells Maydole Nail Hammers, Ball Pein Hammers and all other types. Just ask for the genuine Maydole, if you want hammer satisfaction.

Would you like a copy of our interesting and useful pocket handbook 23B? Just send us your name and address and we'll mail you one free of charge.

The David Maydole Hammer Co.
Norwich
New York,
8718





Make sure your portable is a CORONA

HAVE you ever used a regular office typewriter? If you have, this column will tell you why you should choose Corona as your own personal typewriter. No other portable has so many big-machine features. You'll be at home on it in five minutes.

If you have never used a typewriter, this column will give you a dozen good reasons for making Corona your first and last choice. While you are getting a personal typewriter you may as well have the one that is most like a big office machine—except for weight, bulk, and price.

No other portable typewriter has all these features

THE KEYBOARD has four rows of keys—the same as office typewriters. You don't have to shift for figures.

Instead of a six-yard ribbon, Corona's automatically reversing, two color ribbon is twelve yards long.

The large self-spacing carriage return lever is right up where you want it for quick action. It is the only portable with a real variable line-spacer. There is also a convenient stenciling device.

Corona has a shift key on each side. Back spacer and margin release are conveniently located on the keyboard.

You can see what you are writing without moving your head an inch. The visibility is perfect—and at right angles to vision.

The type bar action operates on exactly the same principle as that employed on all the best full size machines—the type comes up to strike the paper.

The full-width carriage takes a No. 10 envelope—just like any office machine.

Over 700,000 Coronas, more than all other makes of portables combined, prove Corona's durability.

Mail this today

CORONA TYPEWRITER CO., Inc.
108 Main Street, Groton, N. Y.

Please send me latest information about Corona—without obligation on my part.

Name.....

Address.....

The Home Workshop

How to Fit and Hang a Door *Secrets of Applying the Hinges and a Mortise Lock*

By EDWIN M. LOVE, Craftsman and Specialist in Woodworking Methods

ONCE the methods involved are known, the fitting and hanging of an inside door is not a formidable task for the home mechanic.

If the door to be hung is for a closet or other place where only one side is subject to scrutiny, the best side should be placed outward if possible; but, in general, it is best to sight along one side to note if there is any "spring" in the stiles (long side pieces), and if there is, place the concave side against the stops.

Lay the door on a pair of saw horses and cut off the projecting ends of the stiles. If the latter are of fir, the splintering of the under side hardly can be avoided unless the saw is to run nearly horizontal and the final cutting off is done from the under side. This necessitates more care and extra handling of the door, but the resultant smooth surface is well worth the effort.

Next, build a jack as illustrated in Fig. 1. Nail two short lengths of 2 by 6 in. stock to a piece of lath, keeping them apart a trifle more than the thickness of the door. Under the ends of the thin strip nail blocks for feet.

Mark the lock stile and set the door edgewise with one end of the hinge stile in the jack. Plane the lock stile straight with a jointer or the longest plane you have and bevel the edge slightly toward the stop side. If, however, the lock jamb is crooked, which is the case only too often, make suitable allowances.

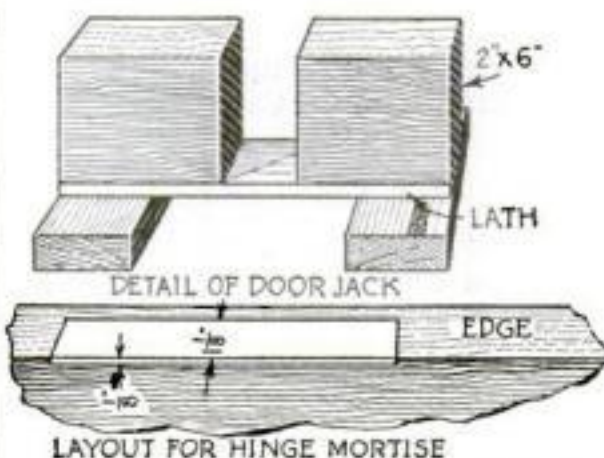


Fig. 1. How to make holder for planing doors and how to mark for the hinge mortises

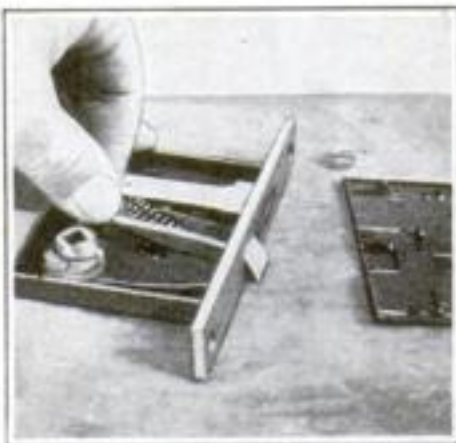


Fig. 4. Reversing the latch bolt after the lock cover is removed



Fig. 2. Marking length of hinge with knife



Fig. 3. "Dapping" the mortise for a door hinge

Now stand the door in the opening, with the lock stile against its stop, and hold the other stile against the jamb edge. Slip a wide chisel underneath for a lever and use a block as a fulcrum. Force the top of the door against the upper jamb and have some one run a pencil down the hinge stile with the jamb as a guide. Lay the door on the horses again and rip off the excess width if it is as much as $\frac{1}{4}$ in. Joint to the line, beveling a little toward the stop side.

Stand the door against the stops, and with scribes or compasses scribe the top rail to the head jamb. Saw and plane to the line, guarding against splintering the stile ends.

THE fitted door should have a clearance of a trifle more than $\frac{1}{16}$ in. all around if the trim is to be painted in the ordinary way, or a little more for a paint job of more than four coats.

Pry the door up to the top, keeping the necessary clearance by inserting a chip or a hand scraper as a gage. Measure from the floor and the upper jamb the distance to the hinges (usually 11 and 7 in. respectively) and with a knife point pressed between door and jamb mark the positions for the hinges on both of them.

Support the door in the jack. Take the pins out of the hinges and set a gage for $1\frac{1}{8}$ in. Score a light line (Fig. 1) the length of each hinge, top and bottom, afterward squaring across for the ends. Take the door half of the hinge, lay it upside down on the stile edge



Fig. 5. Scribing the position of knob spindle and keyhole

(Continued on page 116)

These Are Bolt Clipper Times

VOL. I

EVERETT MASS., U.S.A.

NO. 1

Saving time with a Bolt Clipper

You certainly start a life job when you undertake to discover all of the innumerable ways in which a bolt clipper can be used around the shop, the factory and the home. Every time you discover a new use you face a new way to preserve the purity of the English language and to increase the value of your working day—because a bolt clipper does its work without the aid of strong language and does it quickly. Bolts, nails, wire, rods and chains are essential contributions to housing, transportation, power and construction; from the hen coop to the concrete road; from the wheelbarrow to the motor bus.



Cutting Heavy Fence Wire

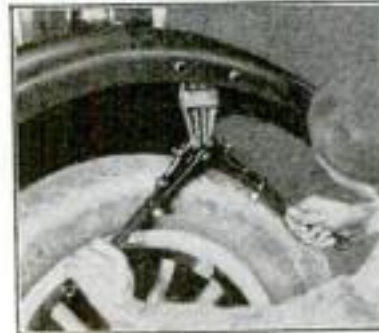
Perhaps you don't know what a bolt clipper is?

It's a tool for cutting off rods, bolts, heavy wire and chains to desired length, anywhere.

When we say bolts we mean big husky ones up to $\frac{3}{4}$ " in size—the kind you find around the automobile mud guards, holding the door plates to the furnace or the sides on the kitchen stove. When we say rods we mean anything from the brass rods which hold up the parlor curtains to those husky iron reinforcements you see in concrete walls.

By wire we mean the clothes line, the radio aerial, guy wires on poles and fences as well as insulated wire on power lines, cables, etc.

As to chains—well of course there are limits to what even a bolt clipper will do but when it comes to the broken links on a tire chain—just reach for the bolt clipper and snip off the broken cross chain.



Cutting Fender Bolt in Hard to Get At Place

Our message to the readers of Popular Science must be general because this magazine reaches all sorts of tool users—men in all walks of life. When we talk to the automobile mechanic, the road builder the railroad man and others we can deal with specific uses in each one's work—but in this issue of the Bolt Clipper Times we can suggest only a few of the thousands of general uses to which the hundreds of thousands of readers may apply this tool. A bolt clipper belongs in every tool kit, on every work bench, in factory, home and farm shop and is an essential item of equipment for railroad construction men, repair crews on power and telephone lines, on ships, fire department apparatus, in mines, lumber camps—and wherever time saving is essential and man power limited.

To those of you who are unfamiliar with these tools just imagine a device so powerful that it will cut a quarter inch rod as easily as the ordinary nipper cuts the small wire on a radio set. Imagine a two handed tool multiplying man power seventy times. Imagine splitting the nut of a bolt in one operation with moderate effort or snipping off a wagon bolt almost as easily as a pair of scissors cuts a piece of twine.



Housewife Cutting Brass Curtain Rod

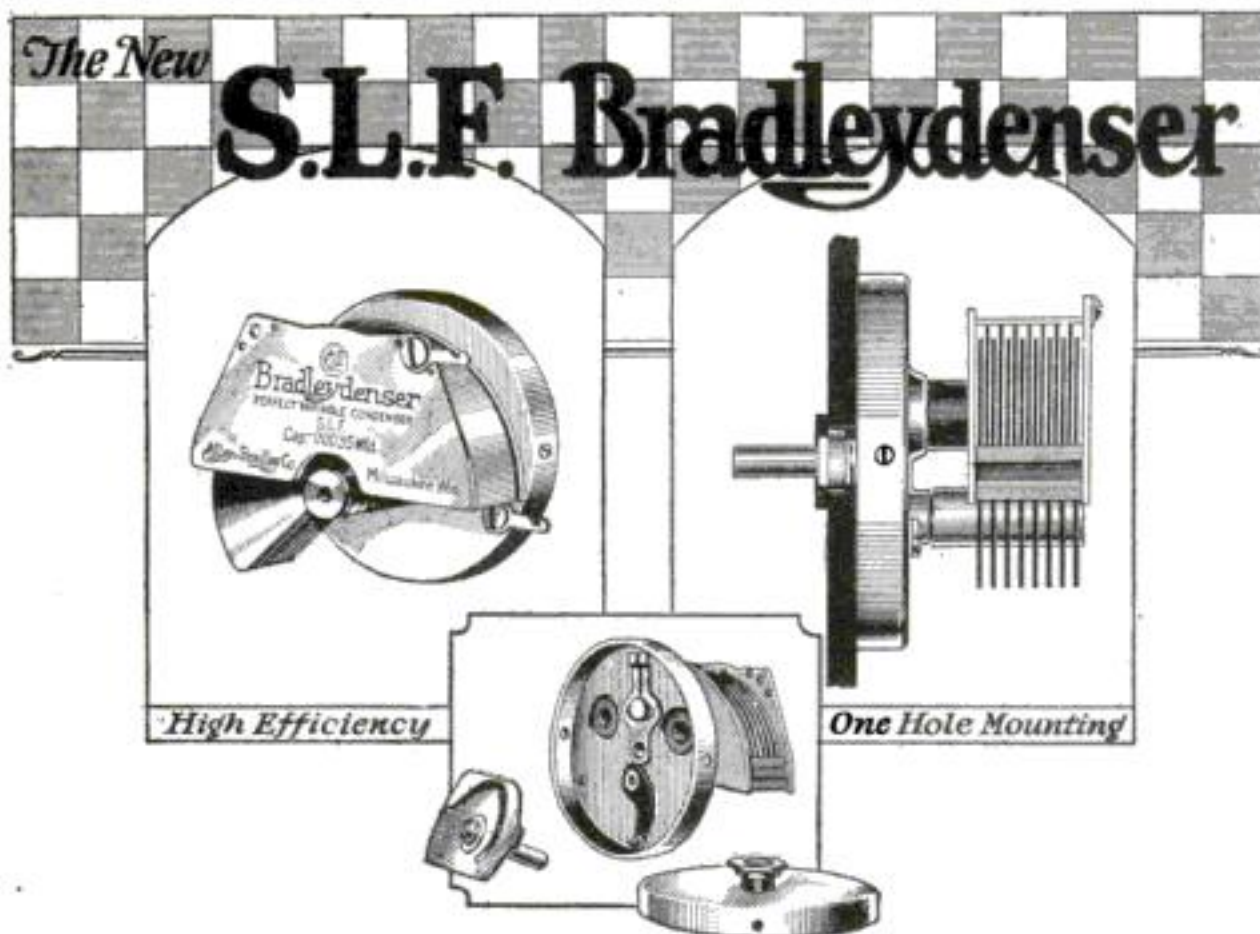


Splitting Nut on Brake Drum

Every hour of every day some man somewhere is laboriously wasting time making work out of a job that should be done with a bolt clipper. If you use tools or if you employ men who use tools we suggest that you write to us or to your tool supply dealer for booklet describing the Porter line of cutting tools. Write to dealer or to H. K. Porter, Inc., Everett, Mass., U. S. A.

ADVENTURES OF PORTER CLIPPER

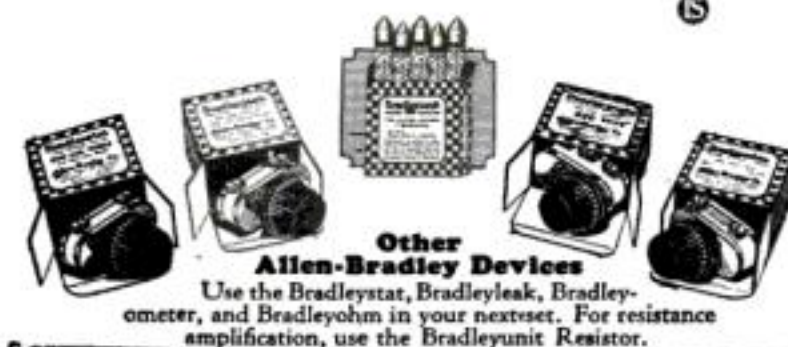




A Compact Straight-Line-Frequency Condenser

THE new S. L. F. Bradleydenser is the outcome of long, careful research in condenser design. It provides straight-line-frequency tuning over the entire circumference of a 360-degree dial. Stations are widely and evenly spaced over twice the dial-spacing of ordinary condensers. This unique control is obtained by using a special cam on the condenser shaft which provides the straight-line-frequency tuning now demanded by all set builders. The efficiency of the condenser is extremely high, due to the unique construction that practically eliminates insulating material in the condenser.

ANOTHER outstanding feature of the new S. L. F. Bradleydenser is the compact design which eliminates entirely the long eccentric rotor plates, ordinarily used with straight-line-frequency condensers. The Bradleydenser can be substituted for any condenser on a set without interfering with other parts on the panel. The one-hole mounting also simplifies installation. The S. L. F. Bradleydenser is the latest Allen-Bradley contribution to better radio. Be sure to bring your set up-to-date by getting a set of S. L. F. Bradleydensers from your nearest dealer.



Mail the Coupon

Allen-Bradley Company,
295 Greenfield Ave.,
Milwaukee, Wisconsin.
Please send us your latest literature
on the new S. L. F. Bradleydenser
and other items of the Allen-Bradley
line.

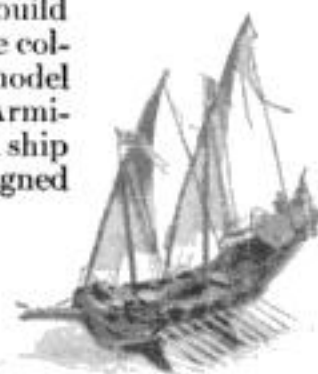
Name

Address

The Home Workshop

Details of Pirate Ship Model Shown in New Blueprint

IF YOU intend to build a duplicate of the colorful pirate ship model that Captain E. Armistage McCann, noted ship model expert, designed especially for POPULAR SCIENCE MONTHLY (see page 80), you will be able to save hours of work and insure the best results by obtaining Blueprints Nos. 44 and 45 in the list below. The first of these shows in full size the hull, deck, bulwarks, and other essential parts of the hull. The second gives details of the masts, spars, sails, flags, guns, oars, lanterns, and various accessories. In most instances the drawings may be cut out and used as templates or else traced, and that saves the work of making full size drawings of your own. The coloring of each part also is indicated.



Complete List of Blueprints

ANY ONE of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to answer any specific questions relative to tools, material, or equipment.

Blueprint Service Dept.

Popular Science Monthly

250 Fourth Avenue, New York

GENTLEMEN:

Send me the blueprint, or blueprints, I have underlined below for which I inclose.....cents:

No.	Title	Published	Price
1.	Sewing Table	Feb., '22	25c
2.	Smoking Cabinet	Mar., '22	25c
3.	End Table	Apr., '22	25c
5.	Kitchen Cabinet	May, '22	25c
8.	Shaving Cabinet	June, '22	25c
9.	Arbor, Gate and Seats	July, '22	25c
10.	Porch Swing	Aug., '22	25c
11.	Bench and Tilt Table	Sept., '22	25c
12.	Electric Washer	Oct., '22	25c
13.	Tea Wagon	Nov., '22	25c
14.	Christmas Toys	Dec., '22	25c
15.	Workshop Bench	Jan., '23	25c
16.	Inlaid Radio Cabinet	Feb., '23	25c
17.	Cedar Chest	Mar., '23	25c
18.	Phone Table and Stool	Mar., '23	25c
19.	Grandfather's Clock	Apr., '23	25c
20.	Flat-Top Desk	Apr., '23	25c
21.	Colonial Desk	Apr., '23	25c
22.	Cabinet and Desk	Apr., '23	25c
23.	Pergola Garage	May, '23	25c
24.	Gateleg Table	June, '23	25c
25.	Canoe Sailing Outfit	July, '23	25c
26.	Baby's Crib and Pen	Sept., '23	25c
27.	Kitchen-Cabinet Table	Oct., '23	25c
28.	Pullman Play Table	Nov., '23	25c
29.	Toy Tea Cart, etc.	Dec., '23	25c
30.	Tool Cabinet, etc.	Jan., '24	25c
31.	Sewing Cabinets	Feb., '24	25c
32.	Chinese Game Table	Mar., '24	25c
33.	Dining Alcove	Apr., '24	25c
34.	Garden Trellises	May, '24	25c
35.	Simple Radio Cabinet	Oct., '24	25c
36.	Rush-Bottom Chair	Nov., '24	25c
37.	Simplified Bookcase	Dec., '24	25c
38.	Sheraton Table	Jan., '25	25c
39.	Salem Chest	Feb., '25	25c
40.	Desk in Sheraton Style	Mar., '25	25c
41.	One-Tube Radio Set	May, '25	25c
42.	Three-Stage Amplifier	June, '25	25c
43.	Four-Tube Receiver	July, '25	25c
44.	Ship Model—Hull	Feb., '26	25c
45.	Ship Model—Details	Mar., '26	25c

Name (Please Print)

Street

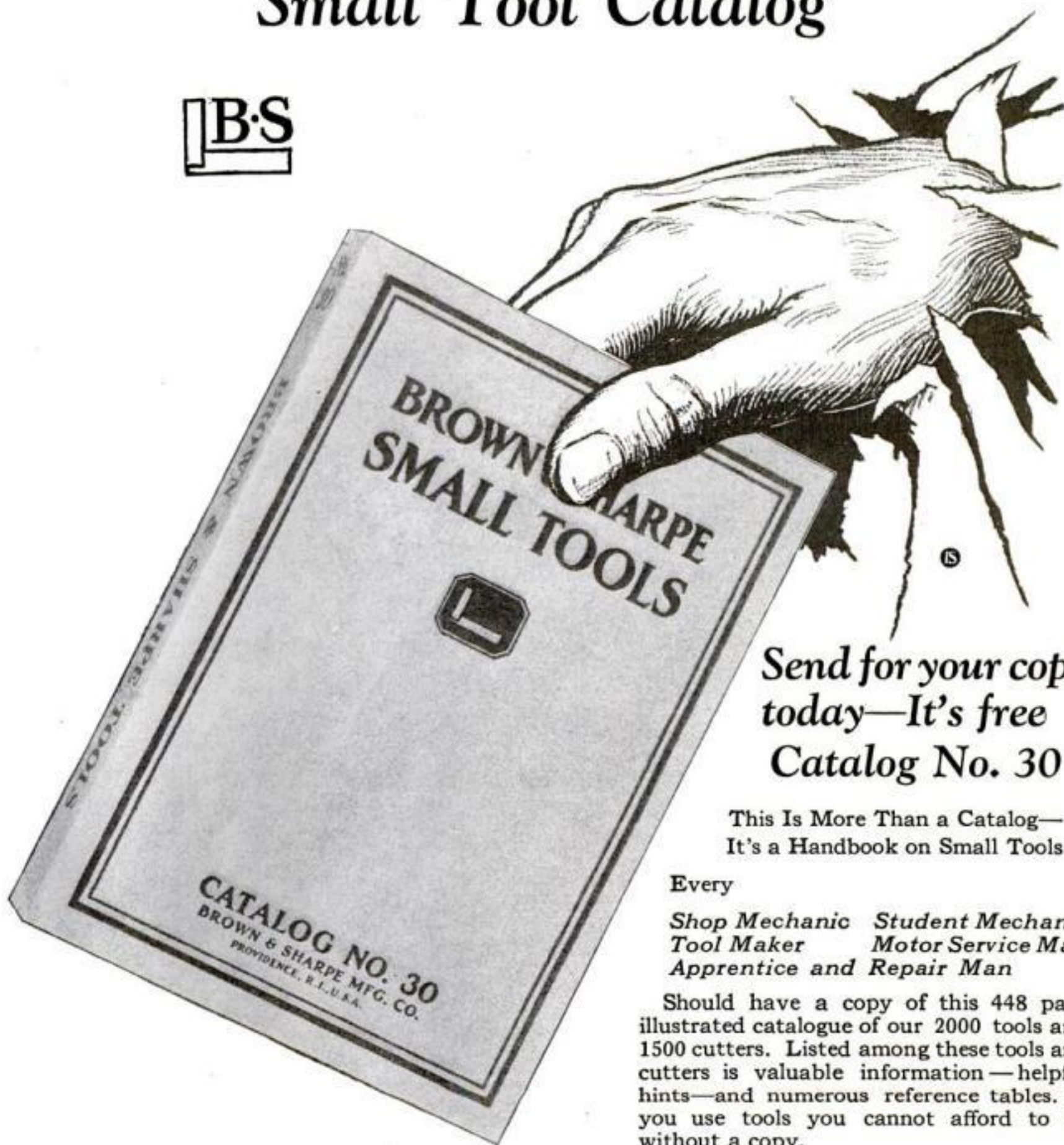
City and State

The Latest Tool Information

The New BROWN & SHARPE

Small Tool Catalog

B.S.



Send for your copy
today—It's free
Catalog No. 30

This Is More Than a Catalog—
It's a Handbook on Small Tools

Every

*Shop Mechanic Student Mechanic
Tool Maker Motor Service Man
Apprentice and Repair Man*

Should have a copy of this 448 page illustrated catalogue of our 2000 tools and 1500 cutters. Listed among these tools and cutters is valuable information—helpful hints—and numerous reference tables. If you use tools you cannot afford to be without a copy.

BROWN & SHARPE TOOLS

BROWN & SHARPE MFG. CO.

Providence, R. I., U. S. A.

BUILDERS

TRADE GUIDES

Audels Builders Guides are fully illustrated—easy to read and understand. Each set is a **Good Trade Course** for the apprentice—and a **Good Reference** for journeyman and master. Use coupon below for free examination.

Audels Carpenters and Builders Guides—4 vols. \$6

Inside information, **illustrated**, for Carpenters, Builders, Joiners, Building Mechanics. **1600 pages; 3700 diagrams; flexible; pocket size.** Short cut instructions, new methods, ideas, solutions, plans, systems—money saving suggestions. An easy progressive course for the apprentice. A practical daily helper and Quick Reference for the master worker. A Helping Hand to Easier and Better Work and Better Pay. To get this aid for yourself, simply fill in and mail the **FREE COUPON** below.



INSIDE TRADE INFORMATION ON:

Tools of The Trade—How to Use The Steel Square—Saw Filing—Joinery—How to Make Furniture—Carpenters and Builders Arithmetic—How to Read and Draw Plans—Specifications—How to Figure Jobs—House and Roof Framing—How to Lay Out Work—Foundations—Doors and Windows—Stairs—Millwork—How to Paint—and hundreds of other subjects, covering the entire trade with pictures and explanations all easy to read and understand.

"Audels Carpenters and Builders Guides are just what every man needs who follows the building trade. He can learn more from your books than he would get a chance to learn in two years work."—J. A. Manning, Lockport, N. Y.

Audels Plumbers and Steamfitters Guides—4 vols. \$6

A new set—just out! A practical, **illustrated**, Reference Library and Study-Course for Master Plumbers, Journeymen and Apprentice Steamfitters, Gas Fitters and Helpers, Sheet Metal Workers, Draughtsmen, Master Builders, Engineers and all Building Trade Students. **1670 pages; 3642 diagrams; flexible; pocket size.** Guide explains all the principles, advances and short cuts of the Plumbing and Heating trade. Contains instructions on how to figure and estimate jobs. Use **FREE** coupon below to examine, without obligation, this valuable work.



INSIDE TRADE INFORMATION ON:

Plumbers Code—Physics—Materials and Tools of The Trade—Lead Work—Water Supply—Drainage—Rough Work—How to make Tests—How to Figure Jobs—Pipe Fitting and Bending—Heating—Ventilation—Refrigeration—Gas—Steam—Sheet Metal Work—Smithing—Brazing—Motors, and hundreds of other subjects covering the plumbing trade. Each point clearly explained in text and pictures that you can easily understand.

"Audels Guides are practical, easy to understand, and can be relied upon. They cover the entire field in plain language."—W. F. Arminger, Annapolis, Md.

Audels Masons and Builders Guides—4 vols. \$6

A new, complete, **illustrated** trade reference library, for Bricklayers, Cement Workers, Plasterers, Tile Setters and Stone Masons, including a practical outline of Steel Construction. **1100 pages; 2067 diagrams; flexible; pocket size.** A practical Trade Assistant explaining modern methods of masonry construction. Easy to understand and apply. A reliable and authentic reference work and study-course for Master Journeyman and Young Mechanic. Use **FREE COUPON** below and find out for yourself, without obligation, whether this set will benefit you.



INSIDE TRADE INFORMATION ON:

Brick Work—How to Lay Brick—Various Bonds and Designs—Brick Foundations—Arches—How to Set Tile—How to Figure Jobs—Concrete Work—Mixing—How to Place Forms—Reinforced Work—Stucco—How to Plaster on Different Surfaces—Stone Masonry—How to Read Blue Prints—Complete Outline of Steel Construction—and hundreds of other subjects with diagrams, pictures, text—easy to read and understand. "Audels Masons Guides are the best books to be had on the subject."—H. A. Sonnet, Corliss Sta., Pa.

Audels Handy Book of Electricity—1 vol. \$4

Audels Handy Book of Practical Electricity, **illustrated**, is a Ready Reference and Study Course in one pocket-size, leather bound book. Every engineer, electrician, mechanic and student will find in this up-to-date Guide the **KEY** to a practical understanding of Electricity. **1040 pages; 2600 diagrams.** A reliable authority and Helper—easy to understand.



INSIDE TRADE INFORMATION:

The entire electrical field is covered in this one volume. Here are some of the chapter headings:

Wiring Diagrams—Calculations—Machine Sketches—Maintenance and Repair—Radio—Armature Winding—Power Storage Batteries—A. C. Motors and Wiring—D. C. Motors and Wiring—Telephone—Telegraph—Ignition—Generators—with Ready Reference Index which gives a quick answer to every problem.

YOUR BIG OPPORTUNITY FOR ADVANCEMENT

To Earn More Learn More

Know your job and you'll never be without one. The skilled man is always in demand. Knowledge is power. Learn your trade thoroughly by easy reading. This coupon is your opportunity for advancement and better pay. You risk nothing in sending for Audels Guides for free examination. Send it NOW!

OUR GUARANTEE

Examine any book published by us without charge. If you like it, keep it. If not, send it back. Pay us only if you are satisfied. No charge if you are not.

THEO. AUDEL & CO.
65 W. 23rd St., NEW YORK, N. Y.

FREE EXAMINATION COUPON

THEO. AUDEL & CO.
65 W. 23rd ST., NEW YORK CITY
Please mail me for free examination the books marked (x) below. If I find them satisfactory, I agree to mail \$1 in 7 days, on each set ordered, and to further mail \$1 monthly on each set until I have paid the purchase price.

☐ 4 CARPENTERS GUIDES \$6 ☐ 4 PLUMBERS GUIDES \$6
☐ 4 MASONS GUIDES \$6 ☐ 1 ELECTRICIANS HANDY BOOK \$4

NAME.....

ADDRESS.....

OCCUPATION.....

EMPLOYED BY..... 3T34

The Home Workshop

What Tools Do You Need?

(Continued from page 72)

Three wished to include $\frac{1}{4}$ - and $\frac{3}{8}$ -in. auger bits and a rose countersink, and three also voted for the $\frac{3}{16}$ -in. size of a bit-stock drill for metal. The always useful hand drill, with its assortment of drill points, also received three votes.

What was more or less surprising was the casting of four votes for an auger bit file, as this is not usually included in a small toolkit. Indeed, this file received four, five, and six votes respectively in the assortments that are to follow.

Next, the jurymen were asked:

What is the ideal assortment of tools for the handyman who wishes to do all possible repairs about the house? This list naturally was arrived at by adding certain tools to the assortment already given. The number of votes given each tool appears in parentheses.

Ideal Shipshape Home Set

All tools previously listed and—
Machinist's ball peen hammer, $1\frac{1}{4}$ lb. (4)
Round mallet, $2\frac{1}{2}$ -in. face (3)
Ripsaw, 24 or 26 in. (5) or 22 in. (1) (Not less than $5\frac{1}{2}$ points to the inch)
Hacksaw frame with blades (5)
Compass saw (6)
Smooth plane (4) or block plane (2)
Carpenter's chisels (socket firmer), $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 in. (5), $1\frac{1}{4}$ -in. butt, bevel edge (3)
Auger bits, $\frac{1}{4}$ (5), $\frac{3}{8}$ in. and $\frac{1}{2}$ in. (3)
Expansive bit, $\frac{3}{8}$ to 3 in. (4)
Rose countersink (4)
Screwdriver bit, $\frac{3}{8}$ in. (3)
Bit-stock drills for metal, $\frac{3}{16}$ in. and $\frac{3}{8}$ (3)
Hand drill with drill points (4)
Pliers, round nose, 5 in. (4)
Files—Saw file, 7 in. (3); round bastard, 6 or 8 in. (4); half round bastard, 6, 8, or 10 in. (3); cabinet rasp, 8 or 10 in. (3)
Winged divider with pencil point, 6 in. (5)
Spokeshave (3)
Drawknife, 8 or 10 in. (3)
Level and plumb (spirit level) (3)
Sliding T-bevel, 8 in. (3)
Tinner's snips (5)
Boxwood folding rule, 2 ft. (3)
Glass cutter (6)
Soldering copper $1\frac{1}{2}$ lb. (3), $\frac{1}{2}$ lb. (2)
Tool grinder (4) Saw vise (3)
Dowel plate (3) Center punch (4)
Nail set, $\frac{1}{8}$ in. (3) Saw set (3)
Scratch awl (3)
Cabinetmaker's clamps, 1 pair, 5 ft. long and 1 pair 8-in. hand screws (3)
Bench of any ordinary type with carpenter's or quick acting woodworker's vise.

In many cases the home worker is not content to confine himself merely to necessary repair jobs. He wants to do a certain amount of simple bench work and make furniture, toys, household utilities, sporting equipment, and the like. What is the ideal assortment of tools for such a purpose? The jurymen answered that question by compiling the following list:

Small Home Workshop Outfit

Nail hammer, bell face preferred (6 votes)
Machinist's ball peen hammer, $1\frac{1}{4}$ lb. (4)
Round mallet, hickory or lignum vitae (5)
Crosscut saw, 22 or 24 in. or 26 in. (6). See note following this list
Ripsaw, 24 or 26 in. (6)
Back saw, 10 or 12 in. (4)
Hacksaw frame and blades (5)
Coping (fret) saw frame and blades or bracket saw frame and blades (6)
Compass saw (6) Smooth plane (5)
Ratchet brace (6) Jack plane (5)
Block plane (6)
Fore plane or jointer (4)
Rabbit plane, $\frac{3}{8}$ or 1 in. (3)
Chisels—mortise, $\frac{1}{4}$ or $\frac{3}{8}$ in. (5); socket firmer, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 in. (6)
Gauge, firmer, beveled outside, $\frac{3}{8}$ or $\frac{1}{2}$ in. (6)
Auger bits, $\frac{1}{4}$, $\frac{3}{8}$, $\frac{1}{2}$, $\frac{3}{4}$, and $\frac{1}{2}$ in. (4 or more votes each)
Expansive bit, $\frac{3}{8}$ to 3 in. (4)
Rose countersink (4)

(Continued on page 90)

No. 231

Pocket Screw-Driver
with different size
blades and reamer
which complete the set.



Send for this handy
Pocket Screw-Driver Set
and a 450-page book of Goodell-Pratt Tools
\$1 brings both to you *Postpaid to any part of the U. S.*

IF you use tools at all, you will need this No. 231 Pocket Screw-Driver Set. And you are almost sure to find in the pocket size Goodell-Pratt Catalog one or more tools you will want to own. Take advantage of the special offer of the Screw-Driver Set and the book of tools. Mail the coupon.

The No. 231 Pocket Screw-Driver Set is a beautiful thing, nickel plated, buffed and handsomely polished. It contains a chuck, 3

screw-driver blades ($\frac{1}{8}$, $\frac{3}{16}$ and $\frac{1}{4}$ inch wide) and a reamer. The smallest blade gets even the smallest screws, such as those in a watch. All three tools are machined, made of best tool steel, hardened and tempered.

The reamer will ream out holes in soft metals and wood. With the tools enclosed in the hollow handle, the set is only $3\frac{1}{4}$ inches long.

GOODELL-PRATT COMPANY
GREENFIELD, MASS., U. S. A.

Toolsmiths

**Tear out this coupon
and mail
with \$1 today**



GOODELL-PRATT COMPANY
Greenfield, Mass.

I enclose ☐ check
☐ money order ☐ cash for \$1.00 for 450-page pocket cata-
log of Goodell-Pratt Good Tools and No. 231 Pocket Screw-
Driver Set.

Name.....

Address.....

City..... State.....



From One Sentence To Millions

ON MARCH 10, 1876, a single sentence was heard over the telephone. Now, after half a century, 50,000,000 conversations are heard each day.

"Mr. Watson, come here; I want you," spoken by Alexander Graham Bell, the inventor, was the first sentence.

His first crude instruments had been tested by sounds and single words; the patent had been granted; the principle was established from which a world of telephones has since resulted. But at that time the telephone had not proved its practical usefulness—its power to command.

Bell's words, electrically transmitted over a wire, brought his assistant from another part of the building. And with his coming, the telephone became a dynamic factor in human affairs.

Since that first call untold millions of sentences have been heard over the telephone. Men have traveled vast distances in answer to its calls. The wheels of great industrial enterprises have turned at its commands. Everything that man can say to man has been carried to a distance over its wires and the thoughts and actions of nations have been influenced through its use.

AMERICAN TELEPHONE AND TELEGRAPH COMPANY
AND ASSOCIATED COMPANIES

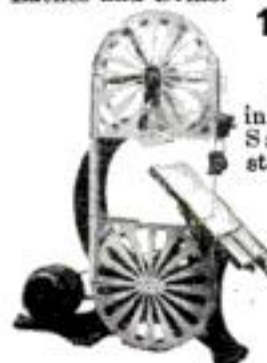


IN ITS SEMI-CENTENNIAL YEAR THE BELL SYSTEM LOOKS FORWARD TO CONTINUED PROGRESS IN TELEPHONE COMMUNICATION

\$100 IN CASH PRIZES SEE PAGE 4 IN FRONT OF BOOK FOR DETAILS

Making It Easy to Build Things!

Men everywhere are finding it easy to build things of wood with Boice-Crane Bench Machines. Write today for new 64-page booklet describing Boice-Crane Circular Saws, Jig Saws, Band Saw, Mortiser, Jointers, Lathes and Drills.



14" Band Saw

Table 12x14 in. tilts 45 deg. Saws 7-inch stock. Uses blades $\frac{1}{8}$ to $\frac{1}{4}$ -inch wide. Bronze Bearings.



8" Bench Lathe

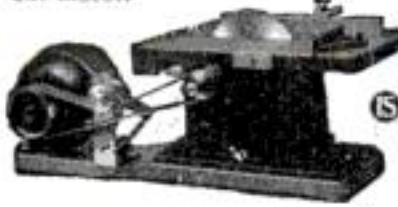
Does turning, drilling, threading, sawing, sanding, grinding and jig sawing in wood or soft metals. Swings 8-inch. Capacity 19 inches between centers.

All Boice Machines driven by $\frac{1}{4}$ to $\frac{1}{2}$ H. P. motor attached to light socket.

W. B. & J. E. Boice Dept. P. S. 3-B, Toledo, Ohio

Junior Saw

Does ripping, mitering, grooving, sanding, grinding and drilling with ease and accuracy. Table 10" x 13". Saws 2 $\frac{1}{2}$ " stock. Does $\frac{3}{4}$ " x $\frac{3}{4}$ ". Makes moulding. Sold with or without motor.



The Home Workshop

What Tools Do You Need?

(Continued from page 88)

- Screwdriver bit, $\frac{3}{8}$ in. or $\frac{1}{2}$ in. (6)
- Bit stock drills for metal, $\frac{1}{8}$, $\frac{1}{16}$, $\frac{1}{4}$, and $\frac{3}{8}$ in. (4 or more votes each)
- Automatic drill with drill points (4)
- Hand drill with drill points (4)
- Screwdrivers, 4 in. and 8 or 10 in. (6)
- Pliers—combination, 6 or 8 in. (6); round nose, 5 in. (5)
- Files—Saw-files, 5 and 6 in. (4); flat or mill bastard, 8, 10 or 12 in. (6); round bastard, 6 or 8 in. (6); half round bastard, 6 or 8 in. (5); cabinet or wood file, 8 or 10 in. (5); cabinet rasp, 8 or 10 in. (5); auger bit file (5)
- Try-square, 6 or 8 in. or combination square (6)
- Steel (framing) square (4)
- Sliding T-bevel, 8 in. (6)
- Boxwood folding rule, 2 ft. (5)
- Zigzag rule, 4 ft. (5)
- Cabinet scraper, 3 by 5 in. (6)
- Marking gage, wooden, or mortise gage (6)
- Dowel plate (5)
- Scriber or divider with pencil point, 6 in. (6)
- Bench, Sloyd, or pocket knife (4)
- Spokeshave (4)
- Drawknife, 8 or 10 in. (4)
- Pipe wrench, 10 in. (4), 16 in. (2)
- Monkey wrench, 10 in. (5), 12 in. (1)
- Tinner's snips (6)
- Level and plumb, 24 in. (4)
- Miter box, wooden or metal (4)
- Glass cutter (6)
- Tool grinder (5)
- Hand screws, one pair, 10 in. (6)
- Cabinetmaker's clamps, one pair 3 ft. or 5 ft. (6)
- Burnisher for scraper (4)
- Saw set (4)
- Wrecking bar, small (4)
- File card or cleaner (5)
- Oilstone, artificial combination (4), Arkansas (a natural stone) (3)
- Nail sets, $\frac{1}{8}$ and $\frac{1}{4}$ in. (6)
- Oilcan (6)
- Half hatchet (5)
- Soldering copper, 1 $\frac{1}{2}$ lb. (4), $\frac{1}{2}$ lb. (3)
- Putty knife (6)
- Bench with quick-acting woodworker's vise (6)
- Cold chisel, $\frac{3}{8}$ in. (6)
- Saw vise (4)
- Glue pot and brush (4)

One point of interest in regard to this list is the fact that a wide difference of opinion developed as to the best lengths of saws. Two of the jurors thought that both a 22-in. and a 24-in. crosscut saw should be included in the list; two of the other jurors voted for a 26-in. crosscut saw, and the remaining two gave a vote apiece for a 22- and a 24-in. saw.

In the rip saw classification one vote was cast for a 22-in. saw, two for a 24-in. saw, and three for a 26-in. saw. The difference of opinion, of course, was due to the belief of some of our jurors that the amateur mechanic should follow the example of the professional woodworker and select a large saw so as to get the benefit of a long stroke, and if he wishes to do fine and delicate work, to buy a saw specially designed for fine cutting and sharpen it accordingly. The opposing view was that in doing small work, which comprises the majority of home workshop jobs, the amateur usually finds it easier to control a shorter saw. Boiled down, it is largely a matter of personal preference, provided the time element does not enter into consideration; for fast work a large saw should be used.

Finally the jury was asked to name the ideal home workshop outfit—a complete equipment, such as will take care of the needs of the amateur mechanic interested alike in house repairs, general woodwork and all sorts of cabinetmaking.

The Ideal Home Workshop Outfit

- All the tools mentioned in the preceding list and—
- Tack hammer (4 votes)
- Light bell-faced nail hammer, about 13 oz., is in addition to nail hammer weighing a pound or a little more for ordinary work (3)
- Riveting hammer, 8 oz. (2)
- Upholsterer's hammer, $\frac{3}{4}$ -in. face (3)
- Soft mallet, rawhide or rubber (3)
- Crosscut saws, 22 and 26 in. in place of the single crosscut saw mentioned in the preceding list (4)

(Continued on page 92)

ATKINS

SILVER STEEL SAWS

"His Favorite Saw"

Better workmen prefer better saws and tools; better hardware dealers everywhere sell them; the ATKINS name on the blade guarantees a better saw for every purpose.

Ask for our booklet "Saw Sense," containing valuable information for every man who uses tools.



E. C. ATKINS & CO.
ESTABLISHED 1857
INDIANAPOLIS, U. S. A.

TAPER GROUND

Compare the cross-section of a Simonds Saw with any ordinary saw. The distinctive taper grinding of the Simonds Blue Ribbon Hand Saw insures ease of cutting—better results with less effort.



The Simonds reputation for quality cutting tools, born of a near century of experience, is your guarantee of quality in any Simonds Saw you buy. Users of Simonds Cross-Cut and Circular Saws have learned to depend upon Simonds quality. Every Simonds Saw MUST be perfect. Ask your dealer to show you a Simonds.



SIMONDS SAW AND STEEL CO., Fitchburg, Mass.
"The Saw Makers" Established 1832
Branch Stores and Service Shops in Principal Cities.

SIMONDS

Pronounced SI-MONDS

SAWS FILES KNIVES STEEL

A new Parks!

Cabinet
Shop Special

No. 7
\$250



Make a real shop in your basement

This handy Parks woodworker is complete shop equipment in itself. With it you can do all sorts of cabinet work. Make toys, furniture, radio cabinets—anything. Built for close, accurate work, yet small enough to fit in a corner of your basement. Operates from light socket. Has motor rip and cut-off circular saw, jointer and bandsaw. Add lathe and shaper at slight extra cost. A real machine ideal for home use. Send for circular.

The Parks Ball Bearing Machine Co.

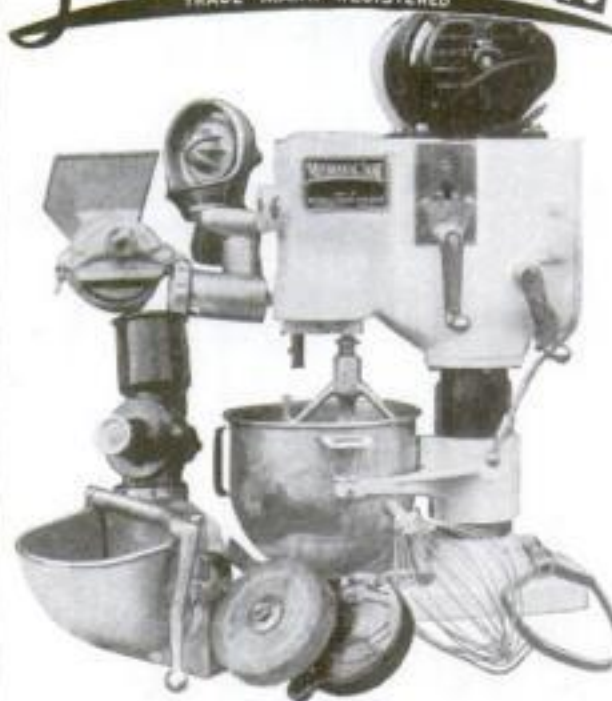
1547 Knowlton St., Cincinnati, Ohio
Canadian Factory: 200 Notre Dame East, Montreal, Canada

PARKS

WOODWORKING MACHINES

MECHANICAL JANE

TRADE MARK REGISTERED



The Electrical Servant

Mechanical Jane is an electrical servant that cuts kitchen work in half. Does mixing, beating, polishing of silverware and cutlery, grinds meat and coffee, slices vegetables, crushes ice, and many other things that require tiresome work. Twelve attachments—easy to change. No modern home complete without it. Latest booklet describing the usefulness of Mechanical Jane mailed free upon request.

Mechanical Kitchen Service Co.

1738 Power St., Cincinnati, Ohio

The Home Workshop

What Tools Do You Need?

(Continued from page 90)

Dovetail saw, 8 in. (2)
Turning saw, 18 in. (3)
Combination plane (6)
Rabbit and filletster plane (3)
Router (3)
Chisels—socket firmer, $\frac{3}{8}$ in. (3); beveled edge butt, $1\frac{1}{4}$ in. (3)
Gouges—firmer beveled outside, $\frac{3}{8}$, $\frac{1}{2}$, and $\frac{3}{4}$ in. (4); beveled inside, $\frac{1}{2}$ in. (5)
Auger bits—complete set up to $\frac{3}{8}$ in.
Bits—gimlet, Nos. 2 to 8 (3)
Square reamer (3)
Screwdriver bit, $\frac{1}{2}$ in. (3)
Automatic (spiral) screwdriver (4)
Jeweler's screwdriver (5)
Pliers—flat nose, 6 in. (4)
Files—saw, 5 in. (3); flat or mill bastard, 8 and 12 in. (6); hand file, smooth, 10 in. (3); square, 6, 8, or 10 in. (3)
Combination square (5) (as well as try-square)
Mortise marking gage (2)
Bit depth gage (4)
Pincers, carpenter's, 6 or 8 in. (4)
Bradawl (4)
Pipe wrenches, 10 in. (5), 16 in. (3)
Adjustable iron miter box (4)
Cabinetmaker's miter block (2)
Doweling jig (5)
Bench duster (3)
Plumb bob and line (3)
Hand screws, at least a pair each, 4 and 10 in. (6)
Cabinetmaker's clamps, one pair 3 ft. (5), one pair 5 ft. (4)
Inside calipers, 6 or 8 in. (3)
Outside calipers, 6 or 8 in. (3)
Oilstones—Arkansas (4), India combination (4), assorted slipstones (4)
Carving chisels—set of 6 or 12 (3)
Prick punch (4) Scratch awl (3)
Center punch (5)
Machinist's vise, $3\frac{1}{2}$ -in. jaws (6)
Cabinetmaker's bench with two wooden vises and bench stops, or bench mentioned in the preceding list (6)
Blowtorch (5)
Pipe vise, if machinist's vise does not have pipe jaws (3)
Taps and dies, small set (6)
Sandpaper block, cork or rubber faced, home-made or purchased (6)

Many other woodworking tools, of course, were given consideration. It was conceded by the jurors that additional tools often came in useful for special work, but the consensus of opinion was that the wisest plan for the average home worker is to purchase such tools as the need for them arises, so that they will not merely lie around in his toolchest, but will be of service from the outset.

Tools in this classification are:

Edge trimming plane, scraper plane, dado plane, curve rabbit plane, dovetail tongue-and-groove plane, shooting board and plane, various special cabinetmaker's planes, corner chisel, many types of files and bits, butt gage, bolt clipper, carpenter's pincers, picture frame and other special types of vises, bench brackets and bench dogs, panel and cutting gages, beam compass, bit and square level, cornering tool, plug cutting bit, dowel sharpener, extension bit holder, circular glass cutter.

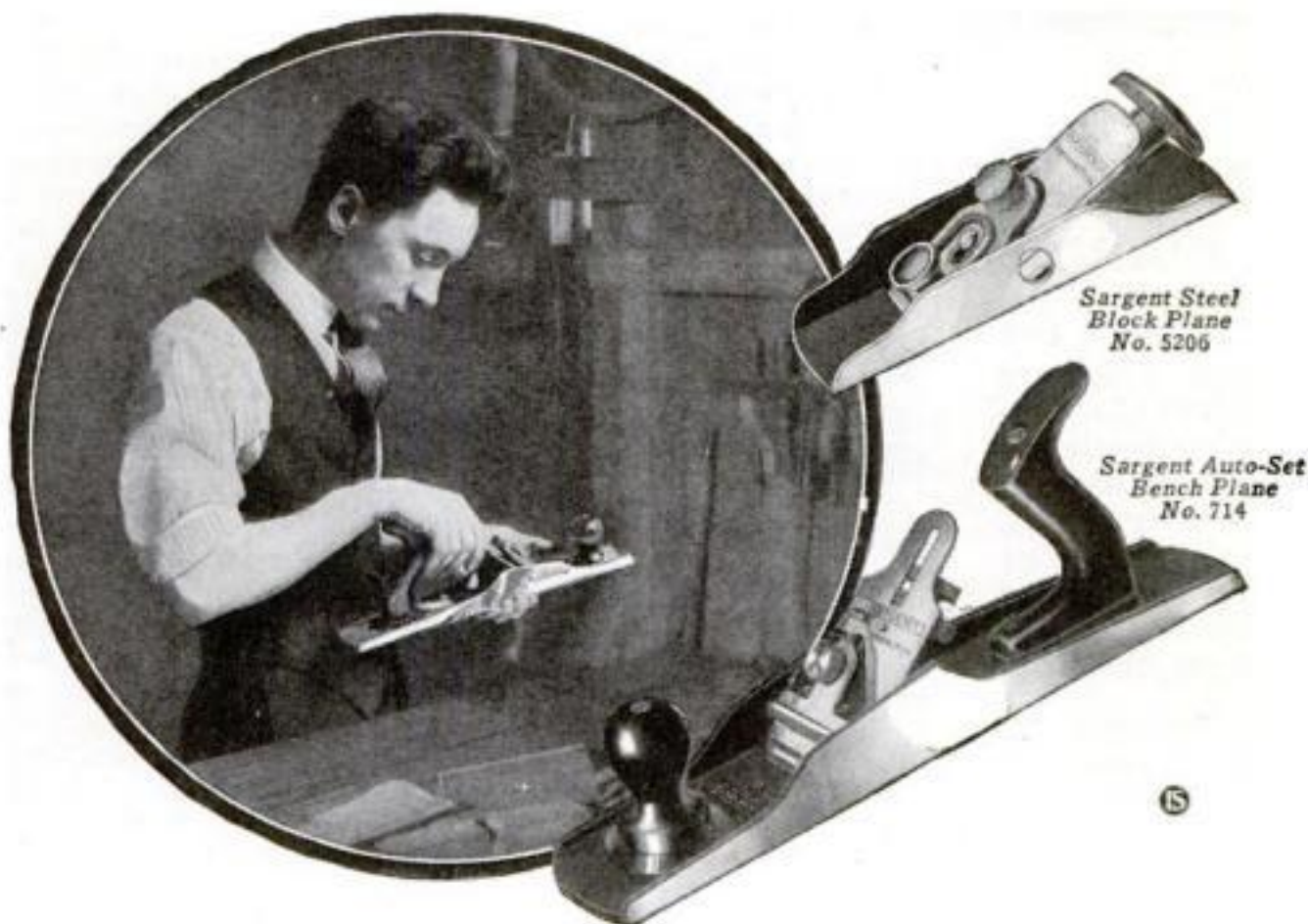
The tools listed are mainly for woodworking; for what might be called a "home machine shop" the assortments would be altogether different.

Mr. Peacock expressed the opinion, however, that no home workshop could be regarded as complete without a bench lathe, and he would include it in both the third and fourth lists. The lathe should have a drill chuck to take drills up to $\frac{1}{4}$ in. He would also include twist drills, wire gage, in sizes from No. 1 to 60.

As the subject of selecting tools involves so many elements of interest to amateur mechanics, the Home Workshop Editor will be very glad to hear from readers and to publish any letters that promise to help other home workers.

SARGENT

PLANES



Are the planes you use at home or school as fine as these Sargent favorites?

THESE Sargent Planes are popular tools with carpenters, manual training instructors and students, and chaps with home workshops. The reason is not hard to find. They are professional tools through and through—time-tested and proved most worthy. Carpenters find them superior for the most difficult jobs. Many school and home work benches can also testify to the quality of the work they do. They resist wear, seldom if ever needing repair or replacement.

The Sargent Auto-Set Bench Plane No. 714—the larger of the two illustrated—is particularly easy to adjust. The cutter of wear-resisting chromium steel can be removed, resharpened and replaced without changing original adjustments. How cleanly and quickly it cuts—across

the grain, against the grain and over rough or knotty surfaces, *with never the slightest chatter*. The Auto-Set is quite a time-saver—a tool of delightful “feel” and balance. It makes the big jobs easy.

The Sargent Steel Block Plane No. 5206 is a convenient plane for the smaller jobs. The low angle of cutter particularly fits it for end work. The cutter here, as in every Sargent Plane, is of chromium steel—selected because of its unusual edge-holding ability.

These two planes will take care of practically every job you’ll ever have. They are versatile, dependable, lasting—and really most economical. You’ll be proud to own both. See them at almost any good hardware store and write us now for free descriptive booklets.

SARGENT & COMPANY, *Manufacturers*, 50 Water Street, New Haven, Conn.



Why Not Cultivate YOUR Musical Bump?

Resolve now to have the pleasure and profit which are yours when you play a Conn instrument. You have the talent—if you can whistle you can learn to play. Entertain your friends, play professionally whole or part time, as you wish. Increase your income. America spends millions for music; get your share.

With a Conn you learn to play quickly. Exclusive features make Conn the choice of the world's greatest artists. On the Conn saxophone you get the patented tuning device, improved simplified key system, straight mouth-pipe, integral sockets, with rolled edges and above all, the new Conn-foil vacuum pads. Let us tell you about these features in detail. With all their exclusive features Conns Cost No More.

Free Trial, Easy Payments

Send coupon now for free book, "Success in Music and How to Win It," by Sousa and other famous artists, and details of trial offer. Mention instrument. Conn is the only maker of every instrument for the band. No obligation; send coupon now.



C. G. CONN, Ltd., 332 Conn Bldg., Elkhart, Ind.
Please send "Success in Music" and details of free trial on

(Instrument)

Name

St. or R. F. D.

City

State, County

(Use pencil, please)

The Home Workshop

How to Make Your Own Screens

(Continued from page 74)

amateur to use a "layout rod"—a stick of wood upon which have been marked the dimensions of the opening. Be sure to mark carefully the location of the middle bar and the total length and width.

The parts of the frame then are marked. About $\frac{1}{4}$ in. is added to the height for fitting, but the width should be exact.

It is best to fasten the side pieces in the vise or a clamp (Fig. 2) and mark the extreme length of both at once. Next, use the cross pieces to lay off the exact location of the ledge or recessed butt joints

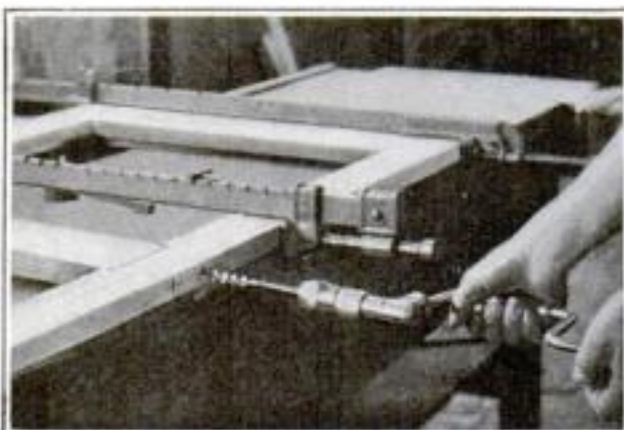


Fig. 10. Boring $\frac{1}{2}$ -in. dowel holes in a door frame after the parts are clamped together

(these are shown most clearly in the central photograph on page 74) and draw lines across with the try-square. Continue lines down on each surface for a distance of $\frac{1}{2}$ in.

Using a marking gage set to $\frac{1}{2}$ in., score lines as shown in Fig. 3 from the extreme end of the pieces to the mark for the cross rails. Do this on both sides and also mark for the center bar. If there is any likelihood that the side pieces are uneven in width, the gaging can be done from the outside edge with the gage set at $1\frac{1}{4}$ in., or $\frac{1}{2}$ in. less than the width.

Place two or more pieces in the vise, make cross cuts down to the gage lines (Fig. 4), and then rip off the wood to be removed (Fig. 5), taking care to cut close to the line. If the surfaces are not true, a chisel may be used to straighten them and a chisel must be used, of course, to remove the wood for the middle bar.

Next, cut the cross pieces to the exact length required, preferably in a miter box, as the ends must be square. After the frame has been tested both for size and squareness, nail it with eightpenny finishing nails, as shown in Fig. 6.

In this work, as in all other exposed to outdoor weather conditions, it is well to apply white lead or thick paint liberally to the joints before nailing them together.

Lay the frame on the bench and smooth both sides with the plane, particularly over the joints, and rub the whole surface with rather coarse sandpaper. (Fig. 7).

Both window and door frames should be painted, oiled or varnished before the wire cloth is applied. Dark green and black are practical colors, and do not show the dirt. Apply a thin priming coat and one or two coats of the ready mixed screen paint. At least three coats are necessary, if frames are to be painted a good white.

The frame is now ready for the screen cloth, which preferably should be copper or some alloy that will not require the frequent painting that is needed to preserve both galvanized and ordinary black wire screening. The mesh should not be larger than No. 16 and finer weaves can be obtained if conditions require it. Extra heavy grades for screen doors are available at well-stocked hardware stores.

With copper insect screen cloth, copper tacks are essential, because when other metals come in contact with copper, corrosion may occur. Tacks should be $\frac{5}{16}$ or $\frac{3}{8}$ in. long. For galvanized and black wire cloth use No. 2 $\frac{1}{2}$ -common blued tacks.

The usual method of stretching wire is to tack one side and pull the opposite side as tightly as possible; then, without much stretching, tack along the third side, and finally tack the fourth side, stretching tightly. If the screen cloth has been roughly handled and kinked, it is practically impossible to stretch it perfectly flat.

Amateurs sometimes have difficulty in the stretching process, but it is a simple matter to obtain all the pressure necessary by the method illustrated in Figs. 8 and 9.

First nail a strip of wood firmly to the bench and tack the end of the wire cloth to it. Butt one end of the screen against the strip and elevate the far end on another strip of wood. Tack the wire at the far end, pulling it taut as possible (Fig. 9). Then remove the support and lower the frame into a horizontal position. If this

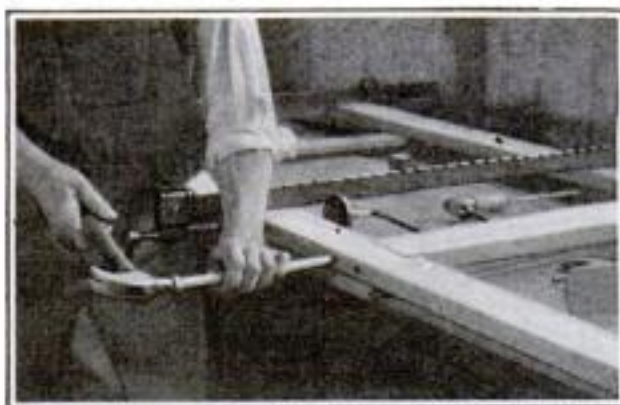


Fig. 11. After the joints and holes have been coated with glue, the dowels are driven home


does not stretch the wire sufficiently, thin wedges can be driven between the screen and the end strip before tacking the wire at that end, that is, the end adjacent to the wedges. The remaining sides then may be tacked as described above.

Screen molding, either half round or of other shapes, may be bought. Plain strips $\frac{1}{4}$ by $\frac{3}{4}$ in. will serve, and they can be made by hand. The corners may be mitered or fitted with a butt joint. If the latter is used, the short pieces are fitted against the upright ones.

The moldings are nailed in place with $\frac{3}{4}$ -in. brads. The wire edges may be trimmed with an old but sharp chisel or knife before or after the molding is applied.

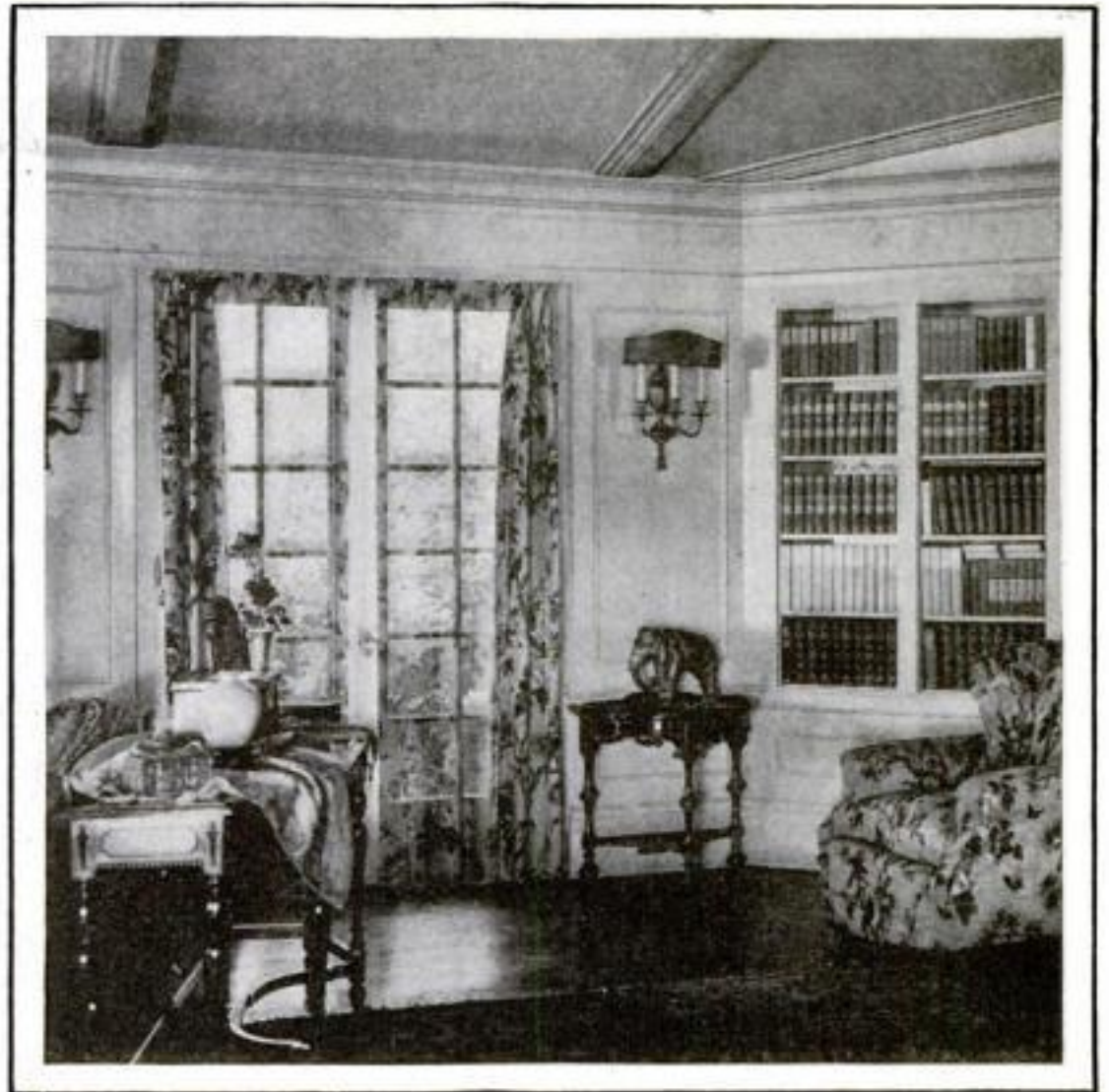
A substantial screen door can be made also by the same process, except that it is

(Continued on page 96)



You, too can use this dependable material

When your plaster ceilings crack or fall.....when you need more space in your attic.....when you want to do "odd jobs"..... See how Upson Board will help you in your home, store or office



UPSON Board comes in big panels of tough processed wood fibre that apply right over old plaster or direct to

studs—in one-third the time of plaster. When painted, you can keep it clean and fresh with a damp cloth. Properly applied, it should never warp or buckle.

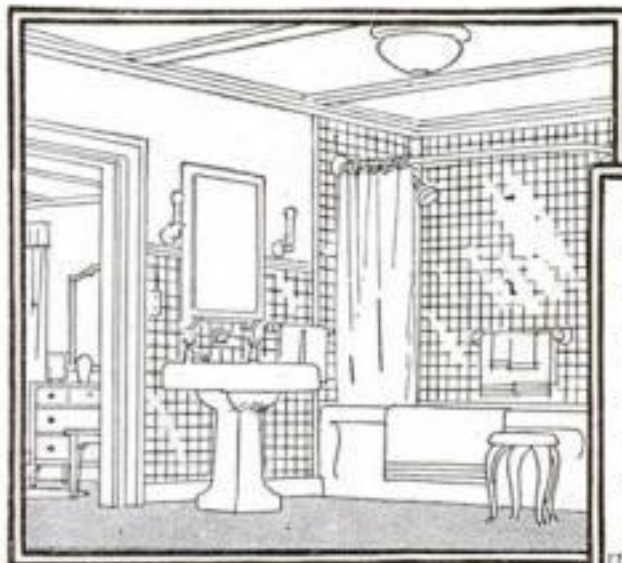
For ceilings—there is nothing better at any price. It is not dangerously heavy.

For insulating—laboratory tests prove Upson Board 10% better than plaster twice as thick. Its use saves fuel.

For sheathing—Upson Board stiffens the framework—adds warmth—and is less costly to apply. Laboratory tests prove Upson Board 25% to 200% stronger than ordinary sheathings.

Write for helpful blue-print—

Why not try Upson Board on a single ceiling that needs repairs—or in your attic to provide additional space and reduce the cost of heating? Mail the coupon.



For baths and kitchens. Upson Fibre-Tile comes in big, sturdy panels that build tile-like walls at 1/10th the cost of ceramic tile.



For sheathing. "Heat and cold proofing as nearly perfect as possible." J. C., Franklin, Nebraska.



For insulating. "Extremely cool in summer-time, comfortably warm in winter." C. F. C., Waldboro, Me.

Do you like to build things?

You'll be surprised to see how easily you can use Upson Board to make waste baskets, table tops, cabinets, dozens of other useful articles. In fact, there is almost no limit to Upson Board uses. Walls,

ceilings, partitions, insulation, sheathing, closets, store rooms, cabinets, laundries, screens, table mats, fruit cellars, are just a few of the things that may be built with this dependable building material.

UPSON PROCESSED BOARD

Look for the famous Blue-Center

for WALLS · CEILINGS · SHEATHING · INSULATION

THE UPSON COMPANY
327 Upson Point
Lockport, New York

Enclosed find ten cents for finished samples of Upson Board and Upson Fibre-Tile and for blue print for.....

(TYPE OF ROOM)

NAME.....

ADDRESS.....

Your Own Snug Little Shop

with a "LITTLE SAVAGE GRINDER"

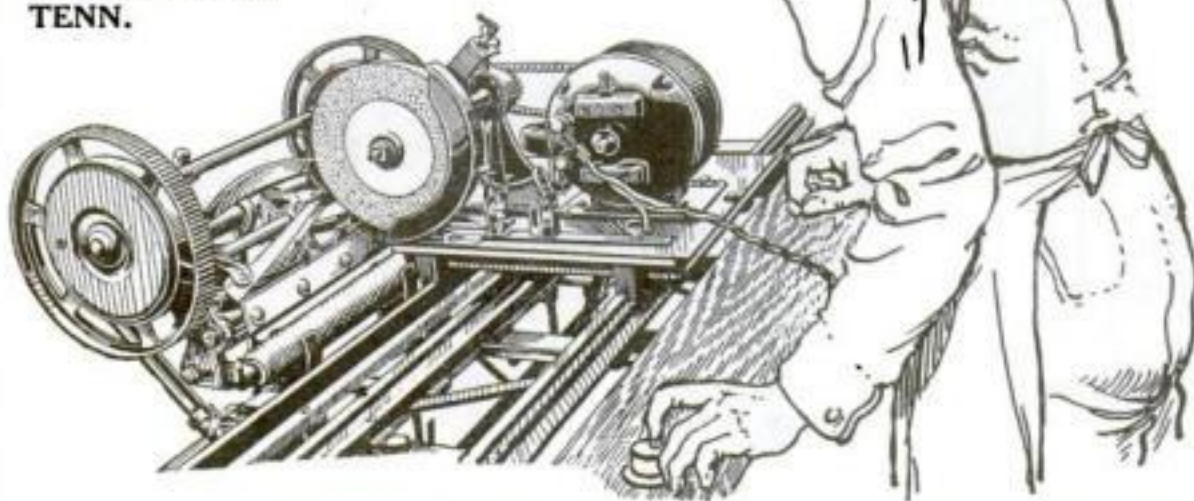
One Man \$1,000 Reports

Made Within a Few Weeks Under Our Wonderful New Big Profit Plan, Sent FREE!

BE YOUR OWN BOSS! Know the joy of manly independence. BE FREE! Come and go as you please. SHARPEN Lawn Mowers, Paper Cutter Knives, Planer Knives, Cutlery, Skates, Make Keys—every household, every store is your customer. Permanent, pleasant, easy business. And your own snug little shop! Write today for our Big Profit Plan—it's FREE. Just address

BROWN MACHINERY CO.
GREENEVILLE,
TENN.

*Sure, Steady
Quick, Easy
Profits*



"B-T"—your protection

Look for the B-T name. To the novice, it is real insurance against an unwise choice—the experienced fan knows the B-T reputation and won't take anything "just as good."

Bremer-Tully honestly believe that each part sold by them is the best available to the radio buyer—for example—

B-T SOCKET



A tube socket that accommodates the present or old type base, the new UX large base and the UX dry battery tube. No adapters necessary. The contact, the important thing, is accomplished by phosphor-bronze springs which are pressed back and are strong enough to maintain constant pressure. The side cutting action makes a clean fresh contact without harming the tube. The springs cannot work loose or be pushed sidewise. Connections are made by soldering to the spring itself or by means of a knurled nut with a keyed head. It is careless to ask your dealer for "five sockets." They are too important to the operation of your set. Ask for B-T Sockets. The price is 75 cents each.

TOROSTYLE TRANSFORMER

Not merely another toroid but a carefully designed air core transformer, the product of the inventor of the Nameless and Counterphase circuits. When used in an efficient circuit, the Torostyle reduces pick up of local signals as well as intercoupling and stray feed backs.

The terminals are accessible for easy wiring and the general appearance of the coil commands instant attention.

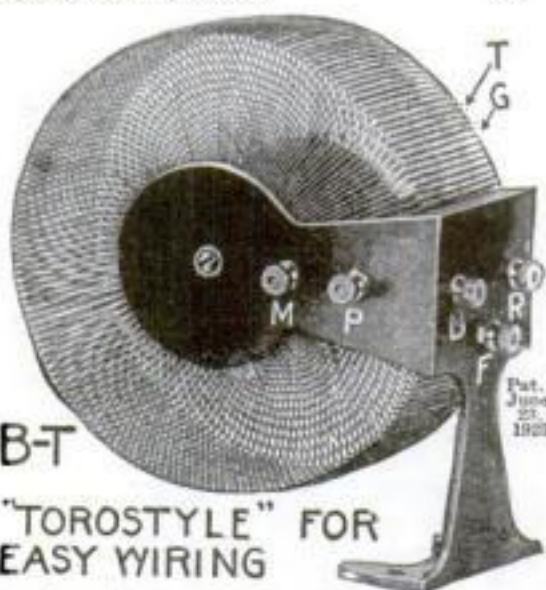
The Torostyle is very efficient when used in the Counterphase circuit, in fact it was designed to be used with it. The Torostyle and the Counterphase circuit have done much to add to Bremer-Tully prestige.

Made in three styles, each for a specific purpose—

Type TA	\$4.00
Type TC	4.00
Type T4	4.00

"BETTER TUNING," an 80-page booklet, describes the application of the Torostyle transformers to the Counterphase circuit, also describes the general line of B-T parts. Sent on receipt of 10 cents.

BREMER-TULLY MANUFACTURING CO.
532 So. Canal St. Chicago, Ill.



B-T

"TOROSTYLE" FOR
EASY WIRING

The Home Workshop

How to Make Your Own Screens

(Continued from page 94)

necessary to use dowels in the joints. The stock used for doors should be $1\frac{1}{8}$ or $1\frac{1}{4}$ in. thick. The stiles (uprights) should not be less than $3\frac{1}{2}$ in. wide, the top rail at least the same width, the bottom rail 9 in. or more, and the middle rail from 4 to 5 in. A door is laid out $\frac{1}{4}$ in. wider than the opening and from $\frac{1}{4}$ to $\frac{1}{2}$ in. longer.

After the joints are fitted in the same manner as has been suggested for window screens, lay the door on some cross pieces on the bench and apply clamps as shown in Fig. 10. Test for squareness and see that there is no twist in the frame. Then mark for the dowels, using a marking gage and try-square, and bore $\frac{1}{2}$ -in. holes with an auger bit as shown. Let the bit go into the cross rails not less than 2 in.

Two dowels should be used in the top and middle rails and three in the bottom rail. If dowels are not to be obtained readily at the lumber yard or hardware store, they can be made by hand.

After all the holes are bored, remove the clamps and put glue in the joints and in the holes of the cross rails. Then assemble the parts, put the clamps on, apply glue thinly to the dowels and drive them in place as shown in Fig. 11. Be sure to plane a small flat along the dowels or cut a notch or saw kerf along them beforehand so that the air and surplus glue can escape. Otherwise you are very likely to split the cross rails.

The door then should be smoothed and the screen wire applied as already described. It pays as a rule, especially if there are children in the house, to protect the lower part of the door with a panel of heavy wire cloth, fastened next to the insect screen cloth with staples.

Metal braces for doors, spring hinges, corner irons, latches, and stops are usually obtainable at hardware stores.

Porch screens can be made, of course, exactly as described for doors and windows, but it is advisable not to have the sections wider than 3 ft.

The method of fitting and hanging window screens is exactly the same as that described for storm sash by F. E. Tustison in an article on page 69 of the November, 1925, number of POPULAR SCIENCE MONTHLY.

How to Identify Door Keys without Looking at Them

DOOR keys may be identified readily by touch alone, if marked in any of the ways illustrated. In A, a hole is drilled large enough to be felt easily. In B, a



piece of fine wire is wrapped around the key and the ends are soldered. In C, one or two holes are drilled and rivets or small bolts are inserted.—HAROLD SMITH.

A de luxe Radio, but not expensive

In Countless Ways a Kolster is Superior

Upon the Kolster has been conferred acknowledged leadership in several directions.

In tonal qualities, Kolster reproduction is a distinct advancement. To hear a Kolster is a revelation.

In simplified operation, a Kolster is unique. Note its easy tuning.

In selectivity and sensitivity, also in every mechanical requirement, a Kolster is superb.

In beauty, too, a Kolster offers the ultimate. Miss Elsie de Wolfe, the world's greatest authority on interior decoration, is designing Kolster cabinets.

Compare a Kolster with what you now think ideal. Your conception of perfected radio will be revised undoubtedly.

To hear and see a Kolster is to know radio at its best. Have a Kolster demonstrated in your own home or at a Kolster dealer's.

The Kolster owner is not only offered all these advancements but he is guaranteed satisfaction by the manufacturer.

So great is Kolster value, so readily is it recognized, that discriminating people everywhere are not content with a lesser instrument.



Kolster Six, dual control, loud speaker enclosed, space for batteries.

A Parade of Stations

One station after another parades by as you turn the Kolster regulator. No meaningless combination of numbers, but the actual names of the stations.

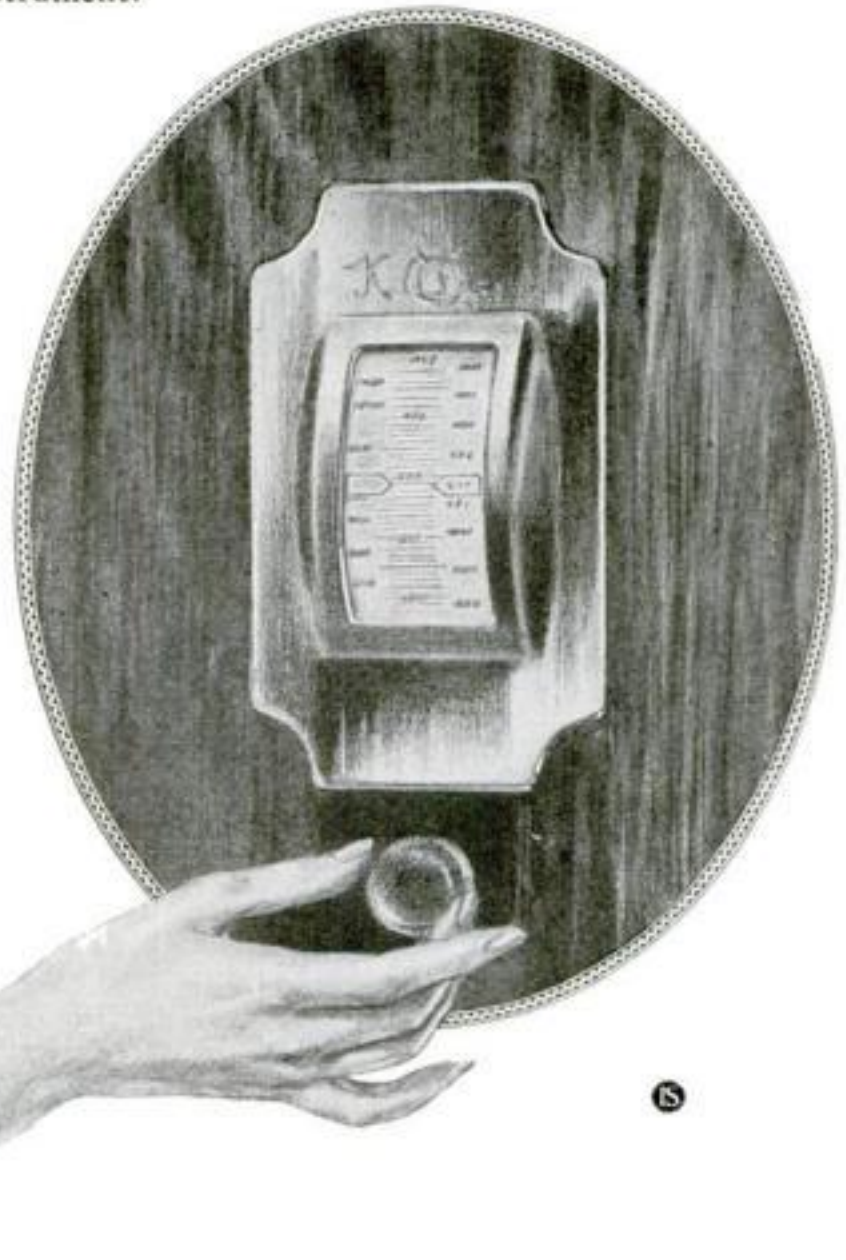
Whatever is on the air comes in easily, perfectly.

To play a Kolster is easier than playing a phonograph.

Radio programs assume new magic—but it is not that their transmission is bettered. The secret is in Kolster perfected reception and reproduction.

Investigate these statements. Hear the Kolster. You will be surprised and delighted. Never have you heard such reproduction.

FEDERAL TELEGRAPH COMPANY
(of California)
Woolworth Building, New York City



KOLSTER RADIO



ELECTRICAL EXPERTS IN DEMAND

Good positions await trained men
Salaries of \$12 to \$30 a day not unusual

THE ELECTRICAL field needs men. It needs them badly. Hardly a week or month passes but what some new use for electricity is discovered. Each new use means new positions—better positions—for men who have trained themselves as experts in this wonderfully fascinating work.

Why don't you study electricity and prepare for a good position at a good salary?

You can do it right at home in spare time through the International Correspondence Schools. Best electrical home-study courses ever offered. Endorsed by Edison and Steinmetz. Successful students everywhere.

Mark and mail the coupon today for descriptive booklet

TEAR OUT HERE

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7685-D, Scranton, Penna.

Oldest and largest correspondence schools in the world
Explain, without obligating me, how I can qualify for the position, or in the subject, before which I mark X.

☐ ELECTRICAL ENGINEER

☐ Electrician

☐ Electric Wiring

☐ Electric Lighting

☐ Electric Car Running

☐ Heavy Electric Traction

☐ Electrical Draftsman

☐ Electric Machine Designer

☐ Telegraph Expert

☐ Practical Telephony

☐ MECHANICAL ENGINEER

☐ Mechanical Draftsman

☐ Machine Shop Practice

☐ Toolmaker

☐ Gas Engineer

☐ CIVIL ENGINEER

☐ Surveying and Mapping

☐ Mining Engineer

☐ ARCHITECT

☐ Architectural Draftsman

☐ Architects' Blue Prints

☐ PLUMBING AND HEATING

☐ Sheet Metal Worker

☐ Navigator

☐ CHEMICAL ENGINEER

☐ Pharmacy

☐ SALESMANSHIP

☐ ADVERTISING MAN

☐ Window Trimmer

☐ Show Card and Sign Painter

☐ RAILROAD POSITIONS

☐ ILLUSTRATOR

☐ DESIGNER

☐ BUSINESS MANAGEMENT

☐ Private Secretary

☐ Business Correspondent

☐ BOOKKEEPER

☐ Stenographer and Typist

☐ Cert. Pub. Accountant

☐ Traffic Management

☐ Commercial Law

☐ GOOD ENGLISH

☐ STATIONARY ENGINEER

☐ CIVIL SERVICE

☐ Railway Mail Clerk

☐ Textile Overseer or Supt.

☐ AGRICULTURE

☐ Poultry Raising

☐ Automobiles

☐ Spanish

☐ RADIO

Name _____

Present _____

Occupation _____

Street _____

and No. _____

City _____

State _____

Business _____

Address _____

4-30-24

BARGAINS!
SAVE $\frac{1}{3}$ TO $\frac{1}{2}$
WRITE FOR CATALOG
RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

Make More Money

Read the Money Making Opportunities on pages 128F to 158 of this issue.

The Home Workshop

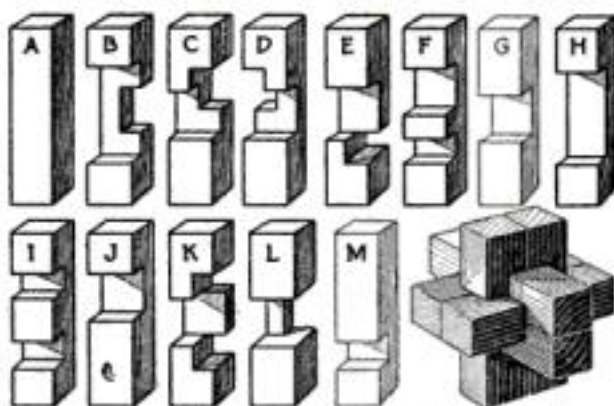
Solving the Famous Block Puzzle in Sixteen Ways

By ARTHUR L. SMITH

SO COMMON is the block puzzle that nearly everybody has tried at some time or other to put one together. It may be thought that all block puzzles are alike. The truth is that they may be of almost endless variety. The whittler may design new ones at will.

The puzzle usually consists of six pieces, $\frac{1}{2}$ by $\frac{1}{2}$ by 2 in. One is a plain block, but the others are cut so that all may be fitted together.

The illustration shows how the various pieces may be formed. A is the plain key



How to whittle the pieces required for sixteen different solutions of the block puzzle

block; it is the last piece to be put in and locks the others in place.

All the cuts in the other pieces are $\frac{1}{4}$ in. deep and $\frac{1}{4}$, $\frac{1}{2}$, or 1 in. long. They are always $\frac{1}{2}$ or $\frac{3}{4}$ in. from the ends. C and D are alike, except that one is right and the other left.

With a set of 18 blocks, three of B, two each of F, H, and J, and one each of A, C, D, E, G, I, K, L, and M, 16 different puzzles may be formed. The order given below is that in which the blocks may be taken for putting them in place.

I. D C B are first fitted, then E B, and the two latter are slid into place, leaving an opening for A.

II. F G B B B A. III. J B F B B A.
IV. I H H B B A. V. J K B H B A.
VI. I L B B B A. VII. B B H K G A.
VIII. H H F B K A. IX. F H F B B A.

All the above combinations have the key block A. In the two following there is no key block and when the joints fit snugly, they are almost as difficult to take apart as to put together:

X. J G B B are fitted, then J K and the latter inserted.

XI. J E B H first; then B M.

A number of combinations may be formed that leave in the center a hollow space that is not discernible when the puzzle is put together. The following are examples:

XII. D J B B B A. XIII. F H B H B A. XIV. J B B H B A. XV. F H D B B A.

XVI. J E B H first, then B and I or F (no key block).

All the foregoing, except two, were originally designed, but others may have hit upon many of the same combinations. It is quite possible that by selecting different blocks out of the series, other combinations differing from those given may be formed. It would take too much space to describe the solutions more clearly here, but that is just as well. The reader who makes any set given will have the pleasure of puzzling it out for himself.

Puzzle fans the country over will be glad to know that this is only the first of a series of articles by the Rev. Arthur L. Smith. To those who are not familiar with his reputation as an authority on puzzles it is sufficient to say that he was for some time the editor of the magazine of the National Puzzlers' League. He has the happy faculty of describing easily made puzzles that will interest the beginner and at the same time amuse the veteran puzzler. This article is a good example, because some of the solutions are simple and others intricate. If you are an old hand at the block puzzle, try solution No. V first.

Walnut End Table with Handmade Spiral Legs

IN MAKING by hand the legs of the walnut end table or console table illustrated, I used a method that has been previously described in POPULAR SCIENCE MONTHLY.

The top of the table was cut from a piece of walnut 1 by 10 by 18 in. The front corners were cut off as shown and the top planed, scraped, and sanded. It would have been possible, of course, to make the top semi-circular.

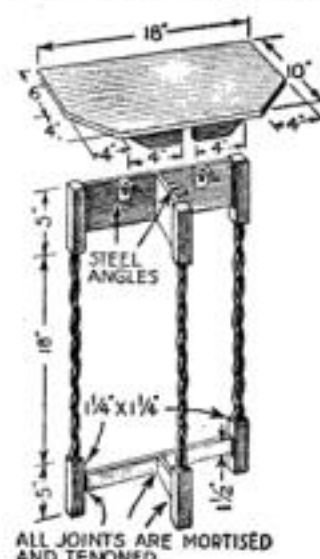
Stock $1\frac{1}{4}$ in. square was used for the legs. Each end was left square for 5 in.; the remainder was carved in a spiral. In making legs of small diameter it is best to use a comparatively long pitch, so a strip of paper about 2 in. wide was

wrapped around the legs to serve as a guide for marking spirals.

The legs were attached to the frame with mortise and tenon joints and the top fixed in place with three small steel angles.

A table of this type may be given either a well rubbed and somewhat dull varnish finish or a shellac and wax finish.

—R. E. DEERING.



How the parts of the table are assembled

9 MILLION Families Have Made Us The WORLD'S LARGEST STORE

Q World leadership can never be the result of an accident. It must be merited. And a continuance of this leadership for years proves that the merit has been well won.

Q One family out of every three in America buys from the World's Largest Store because we sell them better goods for less money. "The Thrift Book of a Nation" is the guide to economy in these homes.

Q Our new Spring Catalog is ready now! Every page proves anew that the World's Largest Store gives the World's Biggest Bargains. But not in low price alone does Sears, Roebuck and Co. excel. We guarantee our goods—because we carry the kind of merchandise that can be honestly guaranteed.

Q Remember we value your good will above everything else. Remember we sell only merchandise that will give you honest service. Remember we ship 99 out of every 100 orders in less than 24 hours. Remember we guarantee a saving.

Q If you are going to buy anything this spring, whether it be for family, home, farm or shop, you must have our catalog—"The Thrift Book of a Nation." It is an index to the best values.

Q We have a copy for you. Just fill in and mail the coupon! But do it today.

Women like to buy from the World's Largest Store because they know the quality of our apparel is dependable. They know, too, that our prices are unbeatable and our styles most appealing. You should have our New Catalog to know what women are wearing this season.



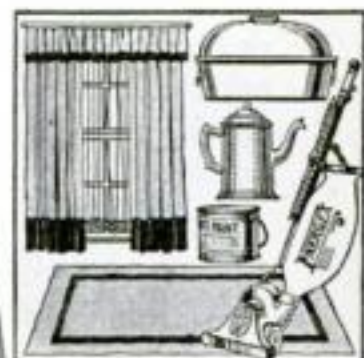
A rod and a reel, a baseball and a mitt, a tent and a cooking outfit, a set of new tires and tubes—these are the things you buy in the spring if you're the kind that enjoys the great outdoors. No high prices in these lines—but lots of quality. Our new catalog shows 35,000 bargains.



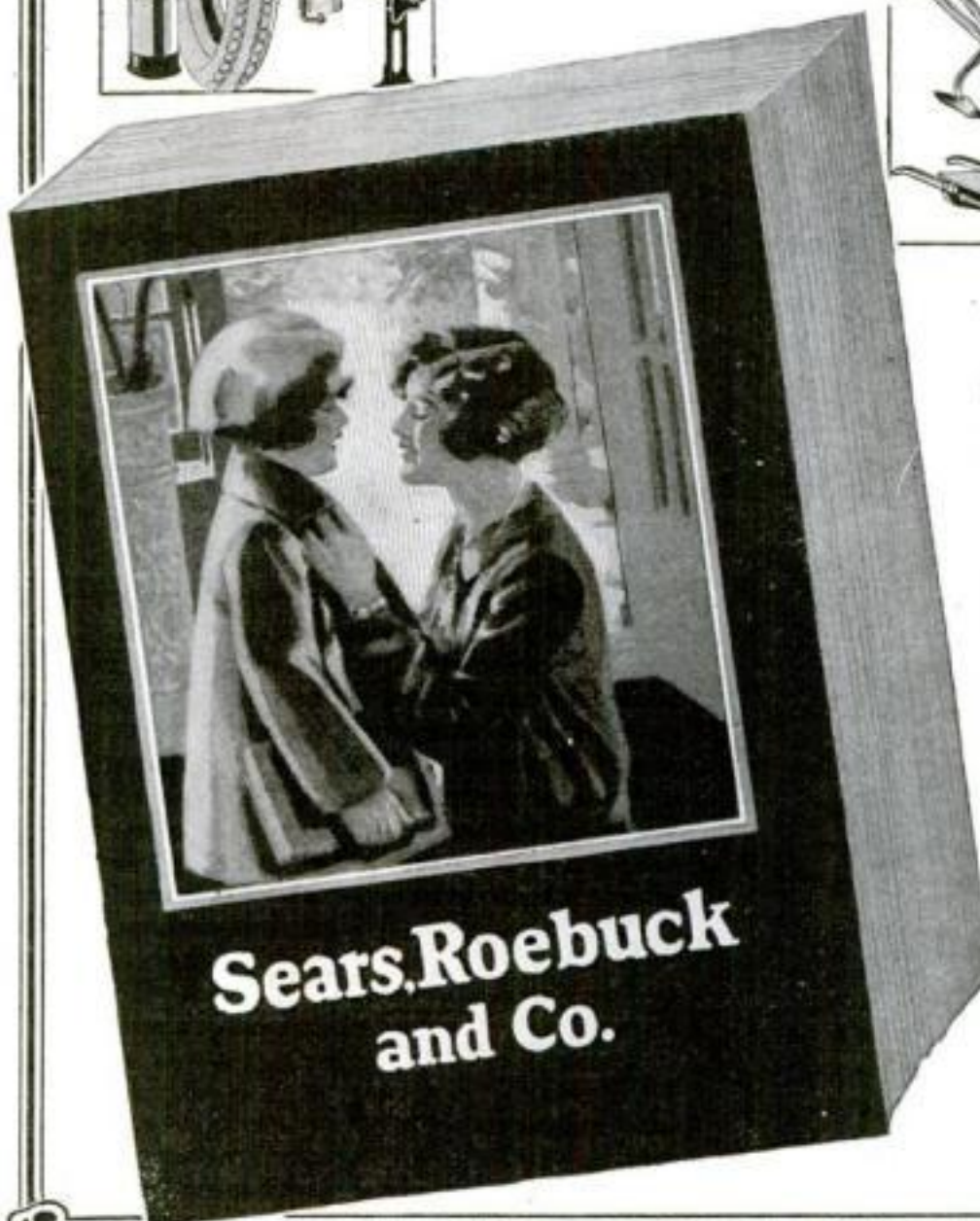
We are value leaders. Our men's clothing and furnishing departments prove it to the satisfaction of 9,000,000 families. You make the greatest savings whether you buy for men, women or children if your selections are from the Thrift Book. And we give real 24-hour service.



Most every American farmer can tell you of the excellence of our farm implements. They can tell you, also, of the big savings they made by buying from the World's Largest Store. No matter what you want for the farm, we have it—and at prices which enable us to guarantee a saving.



To help make your home more livable, to help you enjoy greater comforts is one of our most pleasant tasks. We have paint to brighten it up; new furniture to add to its attractiveness; new utilities to make the work of home-keeping easier. And we have lower prices on everything!



Sears, Roebuck and Co.

Chicago • Philadelphia • Kansas City • Dallas • Seattle

SEND FOR YOUR FREE COPY
OF OUR THRIFT BOOK

Mail the Coupon

WORLD'S LARGEST STORE

We Own and Operate Super-Power
Radio Broadcasting Station W-L-S—
Tune in on 345 Meters

Mail the coupon TODAY to the store nearest you
SEARS, ROEBUCK AND CO. 91P53

Chicago • Philadelphia • Kansas City • Dallas • Seattle

Send me your big Spring and Summer Catalog

Name.....

Postoffice.....

Rural Route..... Box No.....

State.....

Street and No.....

Shall we send FREE our Wall Paper Sample Book?.....



Why Buy a Burgess Flashlight?

WHY buy fire, life, theft or automobile insurance? Or why lock your doors? Simply to guarantee that in emergencies you will receive definite assistance and protection in one form or another which will overcome the immediate danger and possible loss.

Burgess Flashlights have for many years been a convenient and positive guarantee that will guard, guide and aid you against the dangers and inconvenience of darkness.

Don't buy just a flashlight. Ask for Burgess. Look for the distinctive package. The success of Burgess Radio Batteries has proved conclusively the quality of all products of the Burgess Battery Company.

A Laboratory Product

BURGESS BATTERY COMPANY
GENERAL SALES OFFICE: CHICAGO
Canadian Factories and Offices:
Niagara Falls and Winnipeg

BURGESS
FLASHLIGHTS &
BATTERIES

The Home Workshop

How to Make a Seesaw

(Continued from page 82)

Bill of Materials

No.	Pcs.	Part	T.	W.	L.
1		Top board.....	$\frac{7}{8}$	$9\frac{3}{4}$	78
2		Side and rocker planks.....	$1\frac{1}{2}$	$17\frac{1}{2}$	36
1		Stiffening block....	2	10	22
2		Broomstick handles			17

Stout screws, heavy nails, colored pictures, flat white paint, putty, white enamel, and varnish
All dimensions are in inches

17-in. lengths of broomstick. They were cut flat on the bottom for the width of the board and held down with stout screws, countersunk so there would be no projections to catch tender young hands. In the center part they were nailed and screwed from below so as to have sufficient strength to resist rough usage.

All the upper or under edges with which children possibly could come in contact were rounded carefully with a plane or jack-knife.

The outfit then was sandpapered and given one coat of flat white paint, followed by a coat of white enamel. After the latter had dried thoroughly, large colored pictures of scenes interesting to children were cut from various magazines and pasted on the sides and top. Then a coat of heavy varnish was applied over all. The pictures show through this, yet they are covered and protected.

While originally of a pure white appearance, the color has changed gradually to a pleasing old ivory tint. This is probably because of the heavy coat of varnish. If it were desired to retain the white color permanently, a very light varnish coat or perhaps two coats of thin, colorless shellac might be used instead.

The whole thing is just heavy enough so that the children cannot move it around without considerable effort. As a result it stays pretty close to the place where it is put, whether on the porch, in the yard, or in the playroom.

The writer constructed it from material on hand, so that it cost no more than the labor and trouble involved. However, it is believed that the lumber could be bought, as well as the nails, screws, paint, and varnish, for five dollars. That is a small price to pay for the amount of pleasure the children are able to get from the seesaw.

Fitting Irregular Joints

THE amateur carpenter who must fit a board or framework against an irregular surface, can make a templet from a strip of sheet lead or common wire solder. Lightly hammer the soft metal against the irregular surface, bend the ends at right angles as shown, and then use it to mark the mating part.—W. J. E.



Moore pens are not on sale at every store—
at better stores everywhere ~

Moore's Invites Pen Counter Comparisons

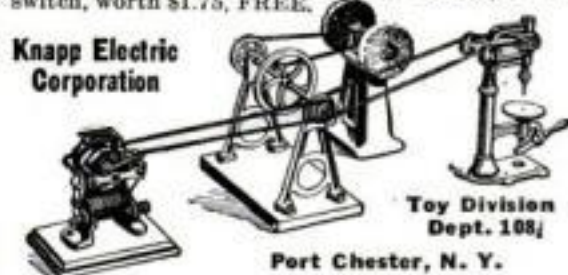
MOORE PEN CO. BOSTON - MASS.

THE WONDER MACHINE SHOP ONLY \$3.50

FAMOUS LITTLE HUSTLER MOTOR FREE

A marvelous emery and buffing wheel, $4\frac{1}{4}$ " high, a bench drill, nearly 6" tall, a three pulley counter shaft with plenty of spiral belting and connectors. All for \$3.50. AND FREE, the famous Little Hustler Motor (runs on a single dry cell), complete with switch, worth \$1.75, FREE.

Knapp Electric Corporation



Port Chester, N. Y.

Stop Using a Truss



Reduced Fee-Simile Gold Medal.

STUART'S PLAPAO-PADS are different from the truss, being medicine applicators made self-adhesive purposely to hold the distended muscles securely in place. No straps, buckles or spring attached—cannot slip, so cannot chafe or press against the pubic bone. Thousands have successfully treated themselves at home without hindrance from work—most obstinate cases conquered.

Soft as velvet—easy to apply—inexpensive. Awarded Gold Medal and Grand Prix. Process of recovery is natural, so afterwards no further use for trusses. We prove it by sending Trial of Plapao absolutely FREE. Write name on Coupon and send TODAY. **FREE** Plapao Co., 187 Stuart Bldg., St. Louis, Mo.

Name.....
Address.....
Return mail will bring Free Trial Plapao.....

Big Value for 10Cts.



6 Songs, words and music; 25 Pictures Pretty Girls; 40 Ways to Make Money; 1 Joke Book; 1 Book on Love; 1 Magic Book; 1 Book on Letter Writing; 1 Dream Book and Fortune Teller; 1 Cook Book; 1 Base Ball Book, gives rules for games; 1 Toy Maker Book, Language of Flowers; 1 Morse Telegraph Alphabet; 12 Chemical Experiments; Magic Age Table; Great North Pole Game; 100 Conundrums; 3 Puzzles; 12 Games; 30 Verses for Autograph Albums. All the above by mail for 10 cts. and 2 cts. postage.

ROYAL SALES CO., Desk 117, Norwalk, Conn.

MOTORCYCLES



LESS THAN HALF COST

Ace, Indian, Cleveland, Harley-Davidson, Henderson Motorcycles and Sidecars, new, used and rebuilt. Rider Agents Wanted. Write for FREE trial offer, agent's free outfit and big bargain bulletin. New American Bicycles in different styles and colors. Write for illustrated catalog giving our money saving prices. **AMERICAN MOTOR CYCLE CO.** 2047 W. Chicago Ave., Dept. 334, Chicago

Equal to a Library of 3000 Volumes

It is no exaggeration, *but the simple, literal truth*, to say that Nelson's Loose-Leaf-Encyclopaedia is of the greatest educational value to the professional man, business man and student

for all practical purposes—far better than a miscellaneous library that would cost many thousands of dollars.

No other Encyclopaedia in the English language can compare with Nelson's in its vast fund of up-to-date reliable informa-

tion. Nelson's Loose-Leaf Encyclopaedia, with the Companion Index Volume and Reader's Guide of thirty-three study courses is a liberal and practical College Education for every member of the family.

JOHN H. FINLEY

Editor-in-Chief

JOHN H. FINLEY, LL.D.

Commissioner of Education and President of the University of the State of New York
1913-1921

Canadian Editor

SIR ROBERT A. FALCONER, K. C. M. G., D.LITT., LL.D.

President, University of Toronto

European Editor

SIR HENRY J. NEWBOLT, LL.D., D.LITT.

Edinburgh, Scotland

Advisory Board

Ronald Amundsen

Arctic and Antarctic Explorer

Wallace W. Atwood, B.S., Ph.D.

U. S. Geological Survey

Stockton Axson, Litt.D., LL.D.

American Red Cross, 1917-19

Moses N. Baker, C.E., Ph.B.

Engineering News-Record

Samuel A. Baldwin

College of the City of New York

Frank Billings, M.D., Sc.D. (Harvard)

University of Chicago

George Rothwell Brown

The Washington Post

John J. Carty, D.Eng., D.Sc., LL.D.

American Telephone & Telegraph Co.

Arthur Robert Crathorne, Ph.D.

University of Illinois

Richard T. Ely, A.M., Ph.D., LL.D.

University of Wisconsin

Charles W. Foss

Financial Editor, Railway Age

Henry S. Graves, A.B., A.M.

U. S. Forestry Service

Charles Holmes Herty, Ph.B., Ph.D.

Editor, Journal of Industrial and Engineering Chemistry

Henry W. Holmes, A.B., A.M.

Harvard University

David Franklin Houston, A.M., LL.D.

Former U. S. Secretary Treasury

Vernon L. Kellogg, M.S.

National Research Council

Julius Klein, Ph.D.

Bureau Foreign and Domestic Commerce

Isabel Ely Lord

Authority on Household Science and Arts

Edgar Odell Lovett, Ph.D., LL.D.

Rice Institute, Houston, Texas

Howard McClenahan, E.E., M.S., LL.D.

Princeton University

Archibald MacMechan, F.R.S.C., LL.D.

Dalhousie College

Walter Charles Murray, B.A., M.A., LL.D.

Saskatchewan University

William H. Park, A.B., M.D., LL.D.

New York Health Department

William Lyon Phelps, A.M., Ph.D., Litt.D.

Yale University

Leo S. Rowe, Ph.D., LL.D.

Director-General, Pan American Union

James Sullivan, A.M., Ph.D.

New York State Historian

Henry M. Tory, M.A., D.Sc., LL.D., F.R.S.C.

University of Alberta

John V. Van Pelt, A.D.G.F., A.I.A., R.A.

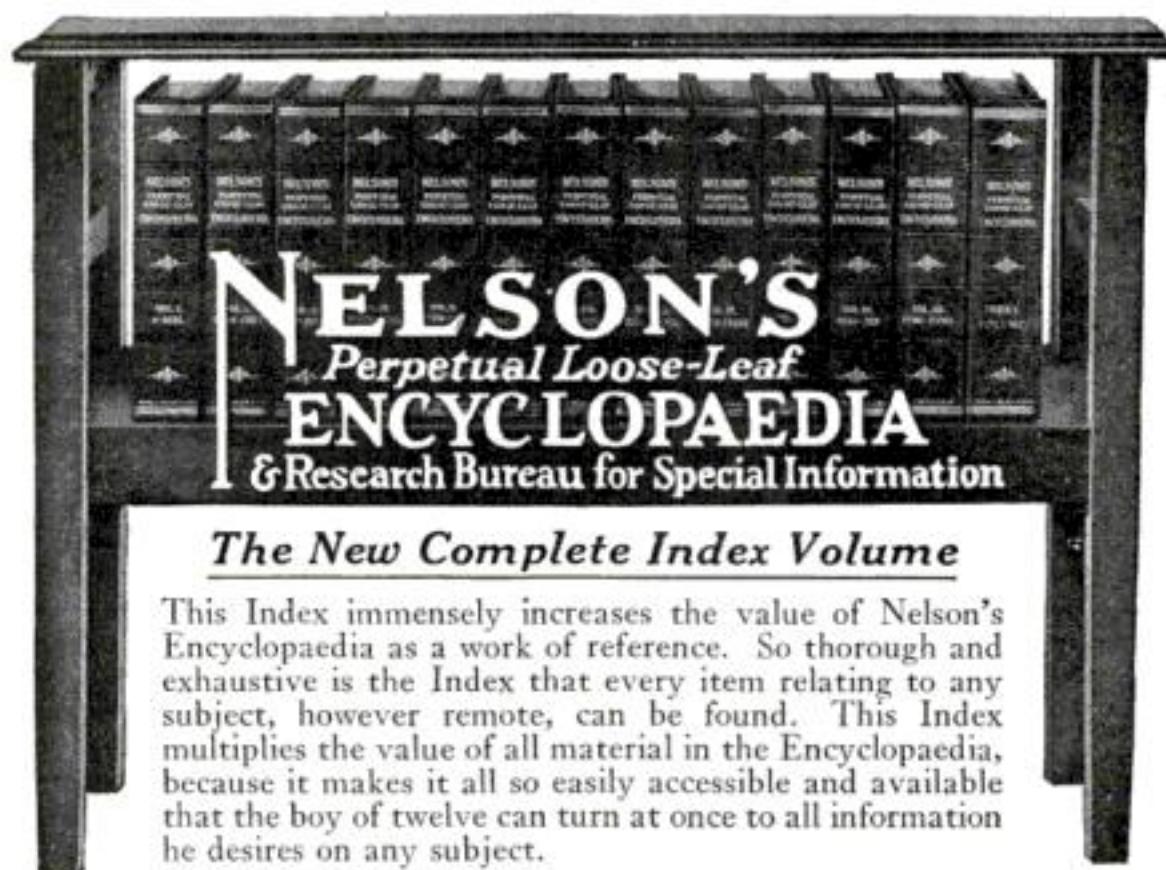
Former Dean College Architecture, Cornell University

William J. Wilgus, D.E. (Hon.)

Civil Engineer

This Great American Encyclopaedia—ALWAYS NEW

Every six months all subscribers to NELSON'S receive their renewal pages—250 pages or more—between 500 and 700 pages each year. These include over 2,000 changes each year and keep NELSON'S perpetually accurate and down to date. NELSON'S treats upwards of 1,000,000 topics, has 500 maps in color and black and white, and 7,000 illustrations, including text cuts, colored plates, charts, etc.



The New Complete Index Volume

This Index immensely increases the value of Nelson's Encyclopaedia as a work of reference. So thorough and exhaustive is the Index that every item relating to any subject, however remote, can be found. This Index multiplies the value of all material in the Encyclopaedia, because it makes it all so easily accessible and available that the boy of twelve can turn at once to all information he desires on any subject.

Why Pay for Old Volumes?

Permanently bound Encyclopaedias cannot be kept up-to-date. It is physically impossible. You struggle through a mass of uncorrelated material in various volumes and supplements, and in the end you can never be sure you have all the information and that it is up-to-date. NELSON'S LOOSE-LEAF is the only really new, reliable and up-to-date Encyclopaedia obtainable at any price.

Nelson's Free Research

Bureau

FOR SCIENTIFIC REPORTS AND SPECIAL INFORMATION AND CORRESPONDENCE. Every purchaser of Nelson's is entitled to free membership in this Bureau. If at any time you are in doubt on any subject, old or new, write to this Bureau with the positive assurance that you will promptly receive the latest obtainable and most dependable information.

Educational Reading Courses

A Reader's Guide to Nelson's Loose-Leaf Encyclopaedia including thirty-three (33) courses on as many subjects—from Aeronautics to Zoology—is furnished without cost to all subscribers. These reading courses are declared by educational authorities to be equal to a college course in each of these departments.

P.S.-3 THOMAS NELSON & SONS

381 Fourth Avenue, New York, N. Y.

Please send me your portfolio of beautifully illustrated sample pages, and full information how, by The Nelson Budget Plan and easy monthly payments, I can own Nelson's Perpetual Loose-Leaf Encyclopaedia and receive FREE Membership in Nelson's Research Service Bureau for Special Information and the FREE Nelson's Reader's Guide.

Name

Address

City..... State.....

THOMAS NELSON & SONS

Publishers of Bibles and Educational Books Since 1798

Originators of the Loose Leaf Reference System

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

WURLITZER

TRADE MARK REG.
THE WORLD'S LARGEST MUSIC HOUSE

200 Years Ago In the little Saxon town of Schoeneck lived Hans Adam Wurlitzer, Master Violin Maker. His shop was a gathering place for musicians of the time, for he was a true craftsman.

When he died his shop passed into the hands of his eldest son, and for seven generations, down to the present day, the descendants of Hans Adam Wurlitzer have carried on his work.

In every Wurlitzer instrument you will find a quality, a character, that could not come from mere excellence of manufacture. It is the heritage of these seven generations of music craftsmanship.



Try any Wurlitzer Instrument in your Own Home

YOU may now have any Wurlitzer instrument for a week's free trial in your own home. Examine the instrument, show it to your friends, play it as much as you wish. No obligation to buy—no expense for the trial. We make this liberal offer because we want you to try for yourself these wonderful instruments, the result of 200 years' experience in musical instrument building.

Easy payments are arranged to suit your convenience.

This is your opportunity to try a famous Wurlitzer instrument in your own home.

Send for New Catalog

The greatest musical catalog ever published! Over 3,000 articles—every known instrument described and illustrated; many of them shown in full colors. Gives you lowest prices and all details of Free Trial, Easy Payment plan. All sent FREE—no obligation.

Send this Coupon

THE RUDOLPH WURLITZER CO., Dept. 1783
129 W. 42nd St., New York 134 Golden Gate Av., San Francisco
329 S. Wabash Av., Chicago 117 E. 4th St., Cincinnati

Send me, absolutely free, your new illustrated catalog, with prices and description of every known musical instrument. Also tell me how I may try any instrument in my own home and pay for it in small monthly sums. No obligation.

Name _____

Address _____

City _____ State _____

Instrument _____
(State instrument in which you are interested)

Copyright, 1924, The Rudolph Wurlitzer Co.

The Home Workshop

Furniture Refinishing

(Continued from page 71)

We turned our attention the next day to the table and removed the top from the frame and the drop leaves from the top.

"Now for the varnish remover," I said.

"But, Mr. Waring, one of the men told me that I ought not to use varnish remover. He did it once and it burnt the work and his hands, too. He told me to be sure and scrape the whole job."

"Good advice once upon a time, Dan, but not any more—at least, not as a usual thing. The only removers your friend knew contained potash or lye. The paint chemist now mixes acetone, benzol, alcohol, and other materials and lets them dissolve or soften the old finish.

"When I apply this remover, notice that I don't work the brush very much. Alcohol and similar liquids evaporate very quickly, so the manufacturer has added a solution of ordinary paraffin to his varnish remover. If you look closely you will see it forming a blanket on top of the remover I have just spread. To do much brush work will result in breaking up the blanket and then the solvents will escape.

"See those wrinkles forming like rows of tiny blisters. Wait until the surface is wrinkled like that, or, as sometimes happens, simply gets soft clear down to the wood. Now take this wide putty knife or scraper and lift off the waste varnish and wipe the knife on a quarter sheet of old newspaper. On these turned parts use a handful of coarse steel wool—Number One will do. Clean off all the old varnish and then take some scrap burlap and wash the table with denatured alcohol to get rid of the last traces of grease and varnish.

"One thing I do want you to remember, Dan, is this: Don't leave any of these rags or papers lying around here or at home to start spontaneous combustion. Put them in the stove and burn them."

The next step was the sandpapering of the frame with No. ½ or No. 0 flint paper backed with a piece of ½- or 1-in.-thick rubbing felt. Care had to be taken not to cut through the veneers.

Dan asked whether veneered mahogany was as good as solid wood.

"That is an old, old question," I told him. "Try and look at it this way: See that beautiful crotch grain you just sanded so smooth? Now we can cut that one-sixteenth inch thick to be glued on a cheap wood core and get ten or more sheets an inch from the log.

"THINK how many more beautiful mirror frames can be made from these veneers than from one-inch boards. Then, too, veneered work is generally stronger than solid and does not warp or split like solid stock. Very few people could afford to have solid crotch mahogany furniture."

The following day Dan came in so early that I noticed the last swallow of lunch disappearing as he entered the room.

Dan had observed that the veneer looked rather light after being sanded.

"I was wondering last night how we



Burning colored shellac into holes too small to patch. If prepared stick shellac is not available, melt flake shellac in a tin cup, add dry colors, and pour into a tin mold to cool. Colored sealing wax also can be used.

could change it," he said. "I went out with mother to see one of her friends who has a couple of nice pieces of mahogany. Her pieces were rather darker and quite red. Brown would suit me better."

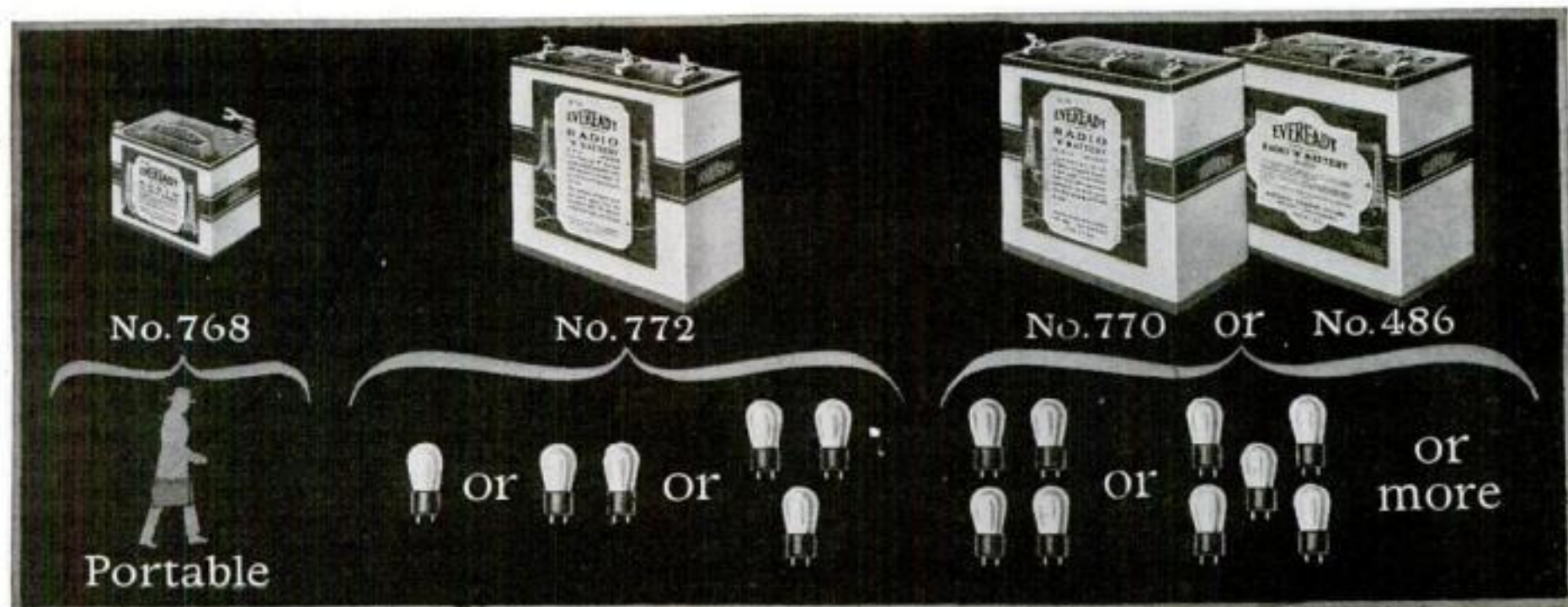
I was glad Dan had used his eyes so well. "You are right about the red tones," I said, "for here is a piece of Honduras mahogany more than a hundred years old, which I keep as a 'pure quill' sample of color. Notice that the general tone beneath the varnish is a brown, rather medium in tone, carrying a slight tint of red, while underneath is a decided base of orange that livens the whole and gives it the real character and golden undertone peculiar to good, honest mahogany. It is hard to find in the black-browns and red-blacks on the market today anything remotely resembling the color as time has produced it on the genuine material. That, however, is no reason why you should spoil your pieces by trying to match present-day shades, since the older sample which I keep is accepted as correct for this class of staining."

WHILE Dan went ahead with his sandpapering, I made up a hot water stain in the proportions of 1 oz. of brown mahogany water stain powder to 1 qt. of water. Dan asked why I mixed my own stain.

"Because a really clear tone and finish can be produced only when a water stain is used. If you find at any time in the future that you cannot obtain water stain powders at your paint store, you will have to get a spirit or oil stain instead. In that case, follow the directions printed on the can or bottle. Prepared stains generally are too dark and need to be diluted, but manufacturers give full instructions."

(Continued on page 104)

Perhaps you, too, can cut your "B" battery costs in half. Just follow the chart. It gives you the secret of "B" battery economy.



THOUSANDS of people have made the discovery that Eveready "B" Batteries, when used in the proper size and with a "C" battery*, are the most economical, reliable and satisfactory source of radio current.

On sets of one to three tubes, Eveready "B" Battery No. 772, used with a "C" battery, will last a year or longer, usually longer. On sets of four and five tubes either of the larger Heavy Duty Eveready Batteries No. 770 or No. 486, used with a "C" battery*, will last eight months or more.

These figures are based on the average use of receivers, which a country-wide survey has shown to be two hours daily throughout the year. If you listen longer, of course, your batteries will have a somewhat

shorter life, and if you listen less, they will last just that much longer.

Here is the secret of "B" battery satisfaction and economy:

With sets of from 1 to 3 tubes, use Eveready No. 772.

With sets of 4 or more tubes, use either of the Heavy Duty Batteries, No. 770, or the even longer-lived Eveready Layerbilt No. 486.

Use a "C" battery on all but single tube sets.

Evereadys give you their remarkable service to the full when they are correctly matched in capacity to the demands made upon them by your receiver. It is wasteful to buy batteries that are too small. Follow the chart.

In addition to the batteries

EVEREADY
Radio Batteries
—they last longer

illustrated, which fit practically all of the receivers in use, we also make a number of other types for special purposes. There is an Eveready Radio Battery for every radio use. To learn more about the entire Eveready line, write for the booklet, "Choosing and Using the Right Radio Batteries," which we will be glad to send you on request. This booklet also tells about the proper battery equipment for use with the new power tubes. There is an Eveready dealer nearby.

Manufactured and guaranteed by
NATIONAL CARBON CO., INC.
New York San Francisco
Canadian National Carbon Co., Limited
Toronto, Ontario

Tuesday night means Eveready Hour
—9 P. M., Eastern Standard Time,
through the following stations:

WEAF—New York	WSAI—Cincinnati
WJAR—Providence	WEAR—Cleveland
WEEI—Boston	WWJ—Detroit
WTAG—Worcester	WGN—Chicago
WFI—Philadelphia	WOC—Davenport
WGR—Buffalo	WCCO—Minneapolis
WCAE—Pittsburgh	WCCO—St. Paul
	KSD—St. Louis
	KGO—San Francisco, 8 P. M. Pacific Coast Time

*NOTE: In addition to the increased life which an Eveready "C" Battery gives to your "B" batteries, it will add a quality of reception unobtainable without it.



You must look closely to see the most important part of this picture—the cables on the ground which bring power from a substation operated from generators 90 miles away.

Digging Coal by Wire

The Northern Pacific Railway mines coal for its own transcontinental trains.

At Colstrip, Montana, was a surface deposit that engineers had never found practicable to work.

Now electric shovels dig the coal and giant storage battery locomotives haul it away to the main line.

Electricity has performed a like service for many industries where natural resources without electricity might have lain dormant for another hundred years.



To help industry and the railroads do their work more economically is an important service, but to save human energy is even more important. The General Electric Company designs and manufactures the equipment by which electricity does both.

GENERAL ELECTRIC

CARTER
(Pat. Pend.)

"IMP" Rheostat
Smallest made, yet most efficient. Smooth running. One hole mounting. Potentiometer same size. At your dealer. \$1.00—All resistances, 3 to 50 ohms.

Carter Radio Co.
300 S. Racine Ave. Chicago

Amaze Your Friends With Chemical Tricks

The Boy's Hand Book of Chemistry
Price 15 Cents

Write secret letters with invisible ink; pour blue, brown and black liquid from a glass of water; make a magic pitcher of bluing; make your own magic writing paper, your own ink and dyes. It's all easy if you have Chemcraft Junior—the pocket Chemical outfit. Get yours now. Order right away and get a FREE Copy of The Boy's Handbook of Chemistry; 100 pages of experiments, formulae, interesting chemical information, money-making suggestions and catalog of supplies.

CHEM-CRAFT JUNIOR
CHEMICAL OUTFIT
PRICE 25 CENTS

BOTH 25¢
THE PORTER CHEMICAL CO.
115 Washington St.
Hagerstown, Md. POSTPAID

The Home Workshop

Furniture Refinishing

(Continued from page 102)

Dan had finished off the frame with No. 4-0 sandpaper. Upon close examination, we found two small holes through the veneer that had been missed in the patching process. These were filled by taking a stick of medium mahogany shellac, heating a soldering iron enough to make the shellac run without bubbling, and melting enough shellac to fill each hole. The tip of the iron was held just above the work. When the shellac had cooled, the surplus on top was cut off with a knife and then the patch was sanded level and true with a nearly worn-out piece of fine sandpaper.

Dan rapped the back of the frame with a brush handle to get rid of the dust in the pores after I had explained that dust left in the wood might give a muddy shade.

A 2-in. black China bristle brush is about right for staining a small piece. The brush should be dipped $\frac{1}{2}$ in. into stain.

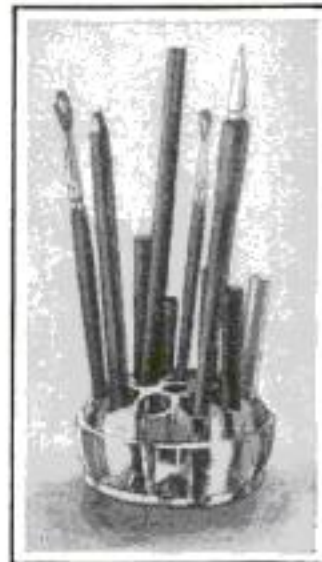
"Apply quickly and freely to the veneer," I told him; "but be careful not to touch the rosewood outband, since that should be left in the natural color. Now take the damp brush and even up the whole job while it is still wet and put the frame aside to dry overnight. Next, sandpaper your table, being sure to sand only in the direction of the grain. If you sand in circles or across the grain, the result will show up like cat scratches on the back of your hand after the wood is stained. If there are any slight bruises you can not sand out, steam them up with a hot iron and wet felt. Let dry and then sand level.

"Use a wood block to back up your sandpaper when sanding the top and drop leaves, since the surface must be absolutely true before varnishing. Be sure to round the edges a trifle, so that the stain and finish will not wear off. Then tomorrow we can begin the real processes of building up the finish, which will bring out and preserve the beauty of the wood, so that your grandchildren can say, 'Granddad Dan finished that mirror when he was an apprentice!'"

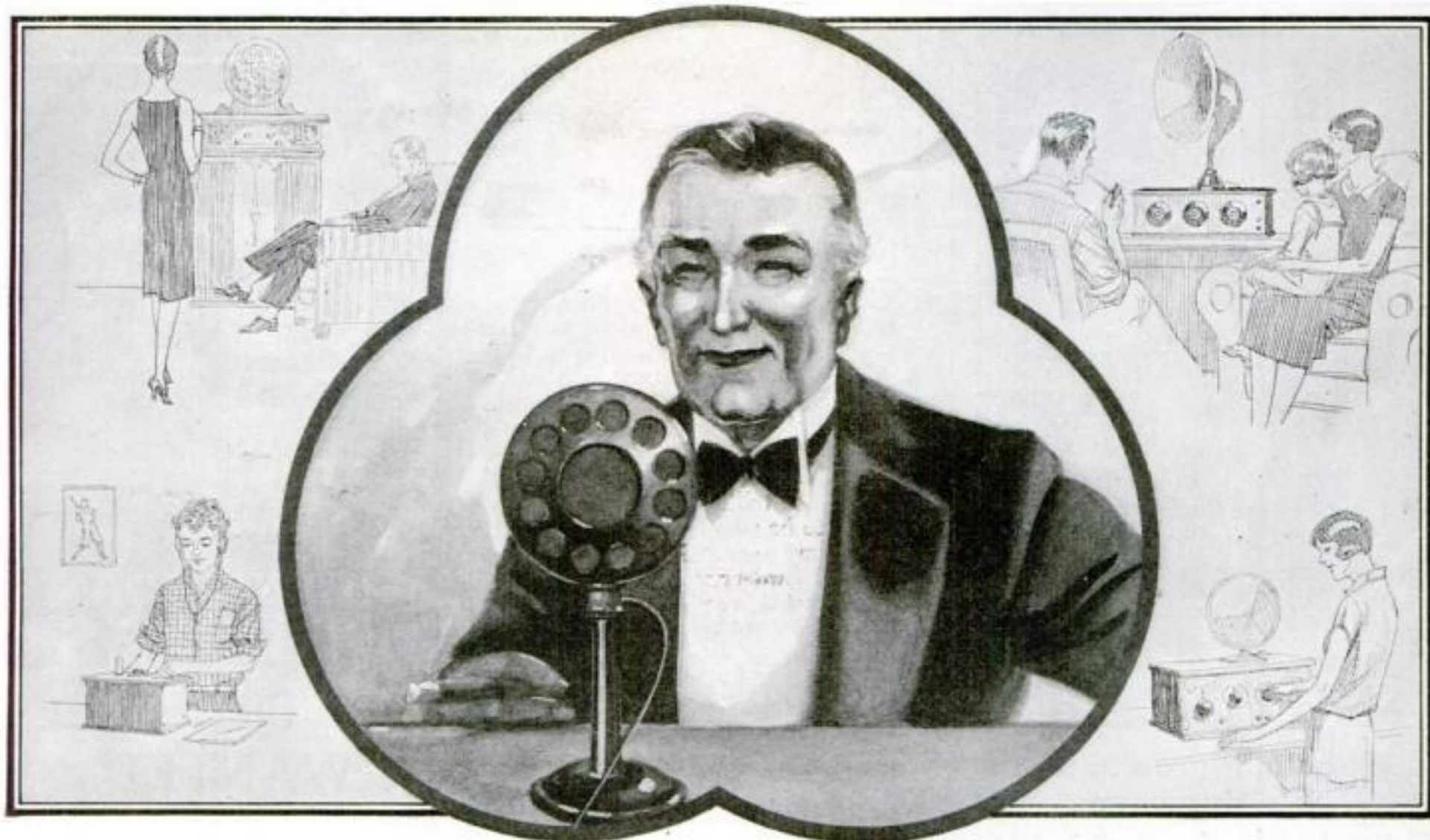
Varnishing will be the subject of Mr. Waring's second article, which will appear in next month's issue.

Holder for Pens and Pencils

THIS little flower holder or "bud vase" serves as a handy pen and pencil holder for a desk or drafting table. The holders may be obtained in various colors and shapes, ranging in price from 10 cents up. What they are really for is to hold the stems of cut flowers.—DAVID J. MORRIS.



A desk novelty



Great names become real folks

The President, the Secretary of Commerce, and scores of leaders in politics, science and industry are no longer mere "names". Through radio they speak direct to you. The very tones of their voices are known to millions.

In bringing Radio broadcast reception within the reach of everyone, Bakelite has had a major part. You will find it in receiving sets, speakers and accessories, for it improves both appearance and performance.

Bakelite is the most widely used material for panels, dials, knobs, tube bases and sockets, rheostats,

variable and fixed condensers and other parts requiring lasting insulation.

In speakers Bakelite is used for magnet spools, housings and diaphragms, as it is unaffected by temperature and atmospheric changes. Because of its resonance it is also used for speaker "bells" and "cones".

It is a fact that over 95% of radio set and parts manufacturers use Bakelite, for they know that its electrical properties, as well as its beauty of color and finish are permanent, unimpaired by time or service.

Write for Booklet 25 a helpful guide when buying a radio set or parts.

BAKELITE CORPORATION
247 Park Avenue, New York, N. Y.
Chicago Office: 636 West 22d Street



Conneroy Elec. Laboratories, Bakelite Tube Base; and Shaw Insulator Co., Binding Posts and mounting



Shaw Insulator Co.,
Tube Socket



Daren Radio Corp.,
Resisto Coupler



Micamold Radio Corp., Grid Condenser
and Leak



Carter Radio Co.,
Flat Plug

BAKELITE

REGISTERED

U. S. PAT. OFF.



THE MATERIAL OF A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation. Under the capital 'B' is the numerical sign for infinity, or unlimited quantity. It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.



"Camera!"

When Cullen cuts in with his Buescher

Cullen Landis, featured in "My Old Dutch", the latest of his Universal releases, spends his idle time at home and on "location" playing his

BUESCHER
True Tone
SAXOPHONE

299

You too have a natural desire to personally produce music. Don't starve that desire. Develop it. We recommend starting with a Buescher Saxophone because it is the easiest of all instruments to learn to play.

You Might Become a Star

Anyone who can whistle a tune can master the Buescher Saxophone quickly. 3 lessons given upon request with each new instrument teach scales in an hour and within a week start you playing popular tunes. From then on its great fun learning, and even though you're only interested for pleasure now, you can in 90 days, if you wish, join a band or orchestra.

Six Days Trial - Easy Terms

You take no risk when you order a Buescher for yourself or for a gift. We will send you any instrument you choose, Saxophone, Cornet, Trombone, Trumpet, on six days trial. If you like the instrument and decide to keep it, pay a little each month. Get the details of this wonderful plan. Clip the coupon below. Send it for the free literature. Send it today. Now.

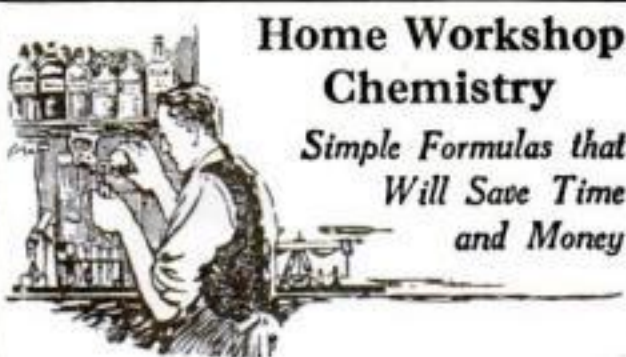
BUESCHER BAND INSTRUMENT CO.
Everything in Band and Orchestra Instruments
1359 Buescher Block Elkhart, Indiana



This beautiful book gives the complete history of the Saxophone, and tells why the Buescher is so easy to learn to play. In it you will find the first lesson chart and many interesting pictures. You must have this fine book.

Clip the Coupon NOW!

Mail BUESCHER BAND INSTRUMENT CO.
1359 Buescher Block, Elkhart, Indiana.
Gentlemen: I am interested in instrument checked below:
Saxophone ☐ Cornet ☐ Trombone ☐ Trumpet ☐
Mention any other _____
Name _____
Street Address _____
Town _____ State _____



Home Workshop Chemistry

Simple Formulas that Will Save Time and Money

SMALL as it is, the beetle family known as *Ptinidae* harbors many destructive insects. One of them is especially damaging to all kinds of furniture as it has a predilection for dry woodwork. This is a species of *Anobium*, the death-watch beetle, a number of forms of which are known.

The activity of this pest makes itself visible by the telltale small round holes which are to be seen in what popularly is called "wormy wood." In addition to these holes a fine powdery wood flour is exuded, the wood dust being produced by the burrowing activities of larvae and beetles.

Since many of the beetles have the peculiar habit of jerking their heads rapidly up and down, tapping the wood, a mysterious clicking sound often may be heard coming from worm-eaten furniture. To the superstitious this sound portends the death of some one in the house, and



Injecting poison into worm holes in a clockcase to kill death-watch beetles, which are about 1/8 in. long



from this strange idea came the designation, "death watch."

This pest can be controlled by dissolving mercuric chloride (a deadly poison that must be handled with the utmost care and kept under lock and key) in alcohol and squirting the solution into the holes of the wood, especially those holes from which the wood dust is being exuded. The solution spreads through the holes and kills the pest.

When the beetles have been destroyed, it is a simple matter to fill the worm holes with a wax made by melting together one part of rosin and three parts beeswax. This mixture can be colored to match the woodwork by adding a small amount of dry color such as raw or burnt umber, burnt sienna, or lampblack.

Sometimes the beetles do so much damage that the wood becomes more or less powdery. It may be hardened by applying several coats of size prepared by gently boiling parchment clippings in hot water for several hours. The size penetrates into the wood and when dry binds the particles solidly together. Any size remaining on the surface may be removed with hot water.

"WHITING-ADAMS"
The Household Buy-word meaning Good Brushes

Look for the name **WHITING-ADAMS** on every brush you buy. *Whiting and Adams* have been household buy-words for brushes for over 116 years — always standing for service and satisfaction.

WHITING-ADAMS BRUSHES

JOHN L. WHITING-J. J. ADAMS CO., Boston, U. S. A.
Brush Manufacturers for Over 116 Years and the Largest in the World

WANTED

Men to manufacture Metal Toys and Novelties. Good chance to start your own well-paying business producing such big sellers as Toys, Novelties, Ash Trays, Book-blocks, Souvenirs, Advertising Specialties, Paper Weights, etc. We furnish forms with complete outfit for speedy production. Absolutely no experience of tools necessary; no special place needed. Small investment puts you on road to success. Demand exceeds supply and we assist and co-operate with our manufacturers in selling their products. We put you in touch with the buyers and assure an outlet for your goods. Strictly a business proposition and thorough investigation invited. A splendid opportunity for an enormous and profitable business for ambitious men. No others need apply. Catalog and information mailed on request.

METAL CAST PRODUCTS CO.
1696 Boston Road New York

Write Today For Our 64 Page Catalog of RADIO BARGAINS

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

LATEST MODELS FULLY GUARANTEED

RADIO'S-10 DAYS FREE TRIAL
SAVE 1/3 TO 1/2

Users everywhere report Miraco Radios get programs coast to coast on loud speaker; outperform sets three times as costly. Many hear foreign countries. Radio's most amazing values in unconditionally guaranteed, factory-built long distance sets—let testimony of users convince you.

Ten Days Free Trial

Powerful New Multi-tube Miraco gets long distance on loud speaker. Set, ONLY \$27.35 retail

FREE! Literature on latest improved 1 to 6 tube models, new low prices, testimony of users and SPECIAL OFFER. Write!

MIDWEST RADIO CORP.
Pioneer Builders of Sets
485-W E. 8th St. Cincinnati, O.

AGENT USERS WANTED Write for discounts.



FLY

Young man learn aviation. Build this classy plane and learn to construct and operate aircraft. Use your motorcycle engine or car "Motor" 20 h.p. motor. We furnish parts very reasonable to build this wonderful little "Meteor-plane," the World's first successful LIGHT PLANE. Send \$3.50 for complete set of blue prints and parts price list of this latest Model M-T-2.

IRWIN AIRCRAFT CO.
116 O St. Sacramento, Cal.



The mark of quality whether you buy or build. Insist upon C-H radio products for highest efficiency in your new set.

"That's Not Only a Beautiful Set, Fred; It Has Been Carefully Designed—Those Sockets Prove It!"

A list of some of the prominent radio manufacturers using C-H products

Acme Apparatus Co.
American Bosch Magneto Co.
Astral Radio Corporation
Boissier Radio Corporation
Chelsea Radio Co.
Crosley Radio Corporation
Dayton Fan & Motor Co.
Dictagraph Products Co.
Dubilier Condenser & Radio Corp.
Electrad, Inc.
Freed-Eisemann Radio Corp.
Garod Corporation
Giffill Bros., Inc.
Allen T. Hamscomb
Harding Mfg. Co.
Howard Radio Co.
The Keyport Laboratories
King Electric Mfg. Co.
Kodel Radio Corporation
LeMor Radio, Inc.
Magnus Electric & Radio Co.
Malone-Lemmon Laboratories
Glenn L. Martin Co.
Wm. J. Murdock
Newport Radio Co.
Pfanstiehl Mfg. Co.
Philadelphia Storage Battery Co.
Radio Master Corp. of America
The Radio Compak Co.
R. B. Radio Co.
Robbins Radio Co.
Signal Electric Co.
Silver-Marshall Co.
Simplex Radio Co.
R. E. Thompson Co., Inc.
J. S. Timmons
Workrite Mfg. Co.
Zenith Radio Co.

"YOU can always tell a carefully designed set by its parts"—any radio set manufacturer will tell you so.

That's why you find so many sets on the market today with C-H sockets, rheostats and switches. For manufacturers know by careful testing the advantages that hundreds of thousands of radio fans have found in C-H features through years of "building their own."

C-H Low Loss Sockets, for instance, settle once and for all one of the most annoying of all set troubles—loose contacts at the tube prongs. In C-H sockets each tube prong is firmly held in the one piece, *silver-plated*, double grip contacts. Jarring of the set or corrosion cannot alter the perfect contact. They are easily wired and give a finished appearance to any set.

So whether you buy or build—look for the C-H trade mark. It is a guarantee of satisfaction.

THE CUTLER-HAMMER MFG. CO.

Member Radio Section, Associated Manufacturers of Electrical Supplies
MILWAUKEE, WISCONSIN



The New C-H UX Socket

for the new UX tubes. Same C-H one piece, low loss SILVER plated, double grip contacts as in the C-H original low loss socket with the ORANGE shell. Heat proof Thermoplas body—terminals cannot loosen under heat of soldering iron.

Spring washers under binding posts prevent loosening of hex nuts and assure tight connections. The hex nuts are slotted to permit tightening with screw driver or wrench.

The lugs at the end of the contacts are designed for easy soldering and may be bent down for under wiring.

CUTLER-HAMMER
—Buy Your Radio Parts by Name—

New "Easy Pay" Plan

PUTS ANY LATHE IN YOUR SHOP

Send for big Free Catalog and select the Lathe you want. Make one small payment down and we ship the Lathe at once. You pay balance in convenient monthly payments. In this way Lathe

Quickly Earns Own Cost

by what it saves and makes for you. You don't feel the cost at all. The high quality of

SOUTH BEND LATHES

is recognized everywhere. 33,000 in use in U. S. and 64 Foreign Countries. Write for Free Catalog showing 96 styles and sizes.

SOUTH BEND LATHE WORKS

818 E. Madison St., South Bend, Ind.



13 inch Swing over Bed, 5 ft. Bed Quick Change Gear Lathe, Net Factory Price, \$387. Easy Payments if desired.

I Made \$21.00 In Five Hours

—Writes Peter Werner, III, Sell Madison "Better-Made" Shirts for Large Manufacturer Direct to wearer. No capital or experience needed. Many earn \$100.00 weekly and bonus.

Write for Free Samples

MADISON SHIRT M'FRS, 562 Broadway, New York

SENSATIONAL SALE \$3

Here is a bargain—a genuine L. C. Smith (the only ball-bearing typewriter made) at the **Lowest Price Ever Offered** and at small monthly payments. All the latest improvements; highest quality rebuilt; guaranteed for 5 years.

SEND NO MONEY

Without delay or red tape, we'll send you this typewriter for a 10 day **FREE TRIAL**.

FREE Typewriting Course, Tools, Waterproof Cover if you act now. Write today for Special Offer and free typewriter manual.

Smith Typewriter Sales Corp., 533-360 E. Grand Av. Chicago

Save Your Knuckles!

DID you ever stop to consider how much "finger-grief" a handy little Luther bench vise will save you? On top of that, it makes any tinkering job easier. You can work better with your other tools with a Luther Vise to help you.

Its sturdy steel jaws open farther than the jaws of any other vise of the same size—and the extra heavy steel feed screw assures a tight, unyielding grip that holds. The slide bar, upon which so much depends, is panelled to give almost double strength. Jaws are $\frac{1}{8}$ " to $\frac{3}{8}$ " wider than most vises. Four popular sizes— $1\frac{1}{2}$ ", 2", $2\frac{1}{2}$ " and 3" jaw spread.

Write for free copy of booklet: "Tighten Up"

LUTHER GRINDER MFG. COMPANY
Department A, Milwaukee, Wis
Also manufacturers of Luther high quality tool grinders.

Luther
QUALITY-BUILT VISES

Now Anyone Can Play a HOHNER HARMONICA



This FREE Book Will Prove It!

Thousands of people of all ages, in all walks of life, are now playing Hohner Harmonicas for entertainment, education and inspiration. Thanks to the new instruction book they are enjoying the popularity that comes to those who can play this fascinating musical instrument.

If there is any greater satisfaction than listening to good music, it is surely that of being able to play it. This Free Instruction Book, containing charts, pictures and popular musical selections, will enable you to play the Hohner Harmonica with an ease that is most surprising. Ask your dealer for a copy today; if he cannot supply you, write direct to M. Hohner, Inc., Dept. 182 114 East 16th Street, New York City.

Leading Dealers Everywhere
Sell Hohner Harmonicas
50¢ up.



The Home Workshop

Tying an Underwriters' Knot in a Lamp Cord

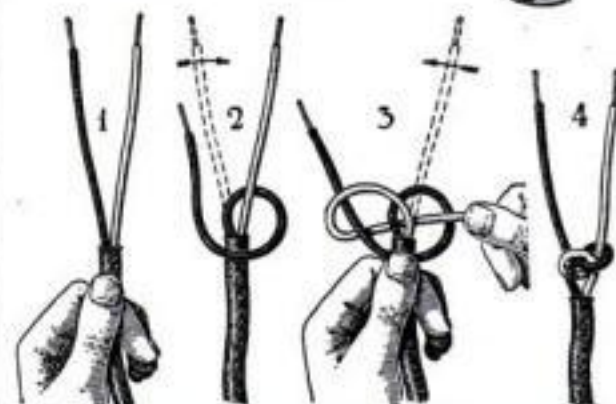
By GEORGE A. WILLOUGHBY

Supervisor of Electrical Work, Arthur Hill Trade School, Saginaw, Mich.

ONE of my neighbors was in his cellar workshop putting the finishing touches on a little lamp stand for his reading table when he received a peremptory summons to the living-room. "Look, dad!" his son exclaimed. "I just pulled a little on this extension cord and the wires came right out of the attachment plug!"

"That's queer," he said. "You must have tugged pretty hard."

But it wasn't the boy's fault, as I told the father later on, when I showed him how to prevent the recurrence of such an accident. The tying of a comparatively simple knot will eliminate trouble of this kind. The knot is used when assembling new extensions, lamps, or fixtures, so that to know how to tie it is the first essen-



Steps in tying an underwriters' knot are shown in Figs. 1 to 4. How the knot is used in wiring a socket is shown in the upper view

tial in wiring work of the kind the home worker has to do most frequently.

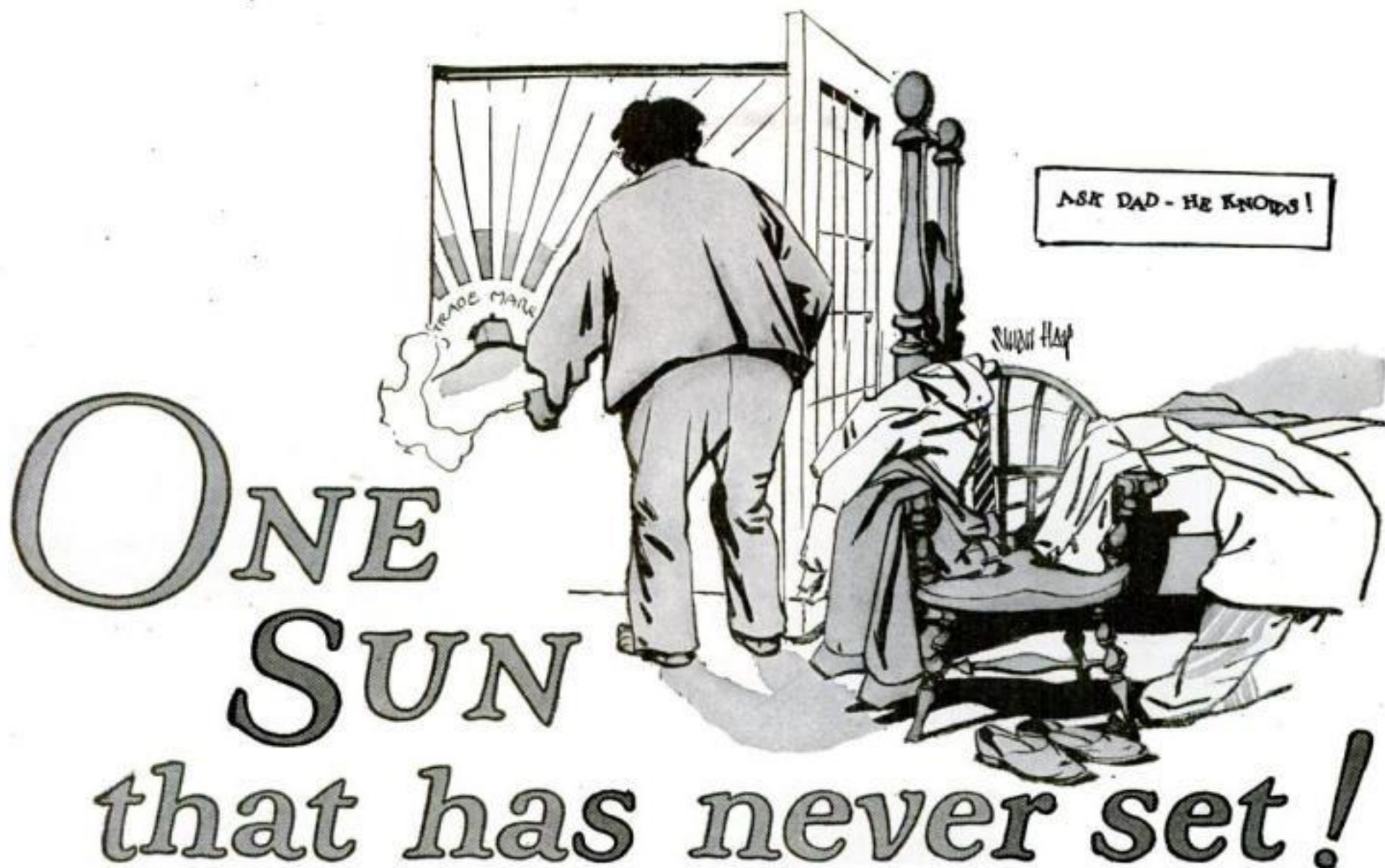
The knot is commonly known as the underwriters' knot, because the code of the National Board of Fire Underwriters requires it to be used. The steps in tying it are shown in the illustration.

Untwist or split the cord in which the knot is to be tied (Fig. 1). Bring one wire back of the other and over to form a loop (Fig. 2). Hold the wire in place with the thumb of one hand. With the other hand bring the second wire down over the crossed portion of the first and pull this second wire from the back up through the loop formed by the first wire (Fig. 3). Pull the ends of the two wires to tighten the knot (Fig. 4).

It is well to practise these steps with a waste piece of lamp cord.

When the knot is omitted in wiring a socket, plug, or fixture of any kind, there is nothing to prevent the strain from coming directly on the connections. Even if the wires are not pulled out entirely, they often become so loose under the binding screws that the lamp fails to light or lights intermittently.

This is the first of a series of articles on electric wiring by Mr. Willoughby.



By Irvin S. Cobb

OVER at the factory they told me that the sales of Sweet Caporal Cigarettes had been mounting up steadily here of late. There was no unusual stimulation in the way of a special advertising campaign. But sales had grown larger and still larger. They are growing while you are reading this. More Sweet Caporals are being sold today than were sold yesterday, more will be sold tomorrow than were sold today.

This condition applies to the re-



tailers all over the United States. According to expert opinion there can be but one explanation to account for so spontaneous and unforced a groundswell in the demand for a brand which has been a standard and a staple for forty-seven years.

The answer is that an increasing number of cigarette smokers in America are turning to the crusty natural blend that suited their fathers and their grandfathers who bought Sweet Caporal Cigarettes before them, a blend of selected Virginia tobacco, made into cigarettes by a process which has never been changed, with the purest of Vermont maple sugar for its savoring, and positively nothing else.

Perhaps you have noticed that part of

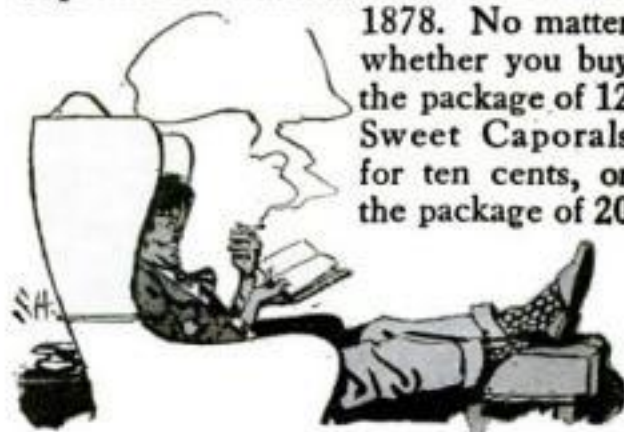
ask Grandad
-he knows
too!

**SWEET
CAPORAL**

*The best smokes he ever had were
"Sweet Caps"*

Guaranteed by
The American Tobacco Co.

the trademark of Sweet Caporals is a blazing sun. That trademark is historic. It appeared on the first package of Sweet Caporals that was manufactured back in 1878. No matter whether you buy the package of 12 Sweet Caporals for ten cents, or the package of 20



Sweet Caporals for fifteen cents, you'll find that same ancient and honorable device upon it. Here is one sun that has never set or sunk in forty-seven years and is rising higher now than it ever rose before. You can't get away from an argument that speaks for itself.

Sweet Caporal, to my way of thinking, is that kind of cigarette. It speaks for itself. And it's speaking louder all the time.

Thank you.

Irvin S. Cobb

P. S. — I write an article like this every once in a while. Watch for the next. I have declined propositions to turn out advertisements for various manufactured articles because I feel I merely would be a hired hand, exploiting this, that or the other thing for so much a word. But I reached for this opportunity. I knew I could put my heart in it—could with sincerity endorse the article I was praising.

A pipe smoker apologizes for years of hate

Reading, Pa.,
August 29, 1925.

Larus & Bro. Co., Richmond, Va.

Dear Sirs:

For years I have read your advertisements and testimonials and laughed at them—until last month. I am now writing this letter as an apology to Larus & Brother Co.

Prejudiced many years ago when I first started to smoke a pipe against Edgeworth because a hated enemy of mine was a constant smoker of it, I refused to fill any pipe of mine with this tobacco.

I smoked almost every kind of tobacco I could buy but your brand. I was what I call a "gypsy smoker." Sometimes I would find satisfaction for a while, but always the tastes of tobaccos would give me repulsive mouth odors. With some, my mouth would have the feeling that it was the uncleanest thing on earth. Some tobaccos even blistered my tongue.

Price was no object. I had paid as much as eight dollars a pound for my smoking mixtures, but I could find no contentment.

Some time ago I was without my pouch and borrowed a pipe-load from an acquaintance, not asking what kind he smoked. We parted and I lit up. I enjoyed it so much I could not wait until I could ask him what kind it was. It was Edgeworth. I was disappointed, but not too narrow-minded to try a can for myself. For a month now, I have hesitated in writing you, in hopes (again I apologize) that I could find fault with it. But I can't.

At last I am satisfied and I am willing to forget that feeling of animosity towards the man who first prejudiced me against your peerless smoke, for I see now that he had more common sense than I.

So I apologize and thank you for doing something I thought could not be done—giving me a smoke I could really enjoy at all times. We are friends for life.

Sincerely yours,

H. Roth Newpher.

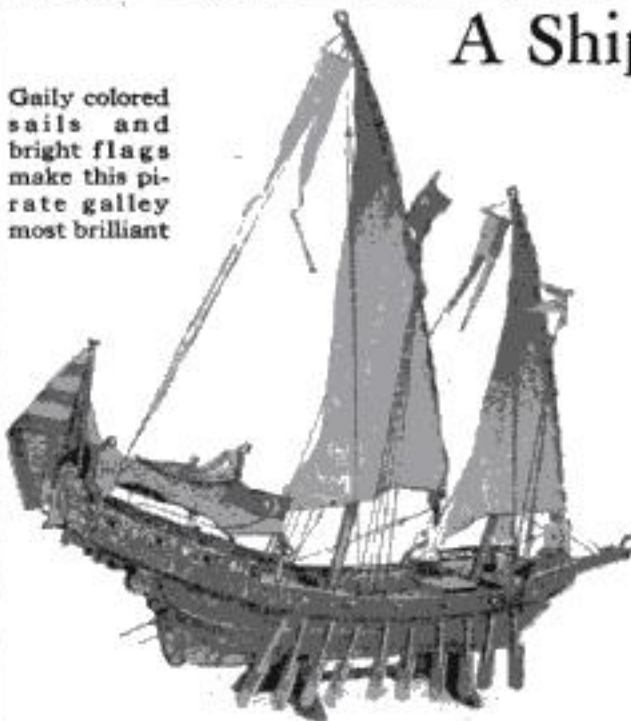
Let us send you free samples of Edgeworth so that you may put it to the pipe test. If you like the samples, you'll like Edgeworth wherever and whenever you buy it, for it never changes in quality. Write your name and address to Larus & Brother Company, 10-O South 21st Street, Richmond, Va.—the [On your radio—tune in on WRVA, Richmond, Va.—the] Edgeworth station. Wave length 256 meters.

The Home Workshop

A Ship Model of Your Own

(Continued from page 80)

Daily colored sails and bright flags make this pirate galley most brilliant



red dye. The sails should be hemmed all around, or a piece of light fish line (dyed to imitate rope) may be sewn to the edges with fine brown thread.

The long edge of each sail is sewn to the spar with a marline hitch, which the ladies call a buttonhole stitch. It is the more natural for being a bit loose.

The finished sails should be laid aside until the other deck fittings are in place.

The guns are important. The six on either side of the main deck are made from a $\frac{1}{16}$ -in. dowel stick. Choose a straight grained one, sandpaper the end and run a knife round $\frac{1}{16}$ in. from the end and again $\frac{1}{8}$ in. from the end. Then shave from the last to the first cut until you have cut down about one-quarter, which gives the gun shape.

Cut off at the $\frac{1}{8}$ -in. mark, round off, snip a small glass-headed pin to about $\frac{1}{4}$ in. long, and drive this in the back of the gun. It then should look like the part marked X (below).

The carriages (W) may be made from a square stick $\frac{3}{8}$ by $\frac{1}{2}$ in. The steps and groove can be cut with a fretsaw. The guns should be an easy fit in the grooves.

The bow-chasers for the fore-castle are the same in design, although somewhat larger.

Ladders will be needed to lead from the deck to the poop and fore-castle. These are made from strips of a cigar box about $\frac{1}{16}$ by $\frac{1}{8}$ in. The after ones (R) need to be about $1\frac{1}{4}$ in. long, with the ends of the sides cut at an angle so that they will stand firm. The steps are $\frac{3}{8}$ in. long and all must be exactly the same length. They are glued in position. The forward ladder (S) is about $\frac{1}{2}$ in. long.

There should be two hatches on deck. These are pieces of wood about $\frac{1}{4}$ by $1\frac{1}{4}$ by $1\frac{1}{2}$ in.; the forward one should be somewhat the smaller. A vessel of this kind in reality would have her decks mostly open, but for our purposes that would make the construction much more difficult.

A small boat (U) is needed in case of accident to the ship and for going ashore. It is called a caique. It can be whittled from any piece of soft wood, stained

brown, and rested on two small square sticks or chocks.

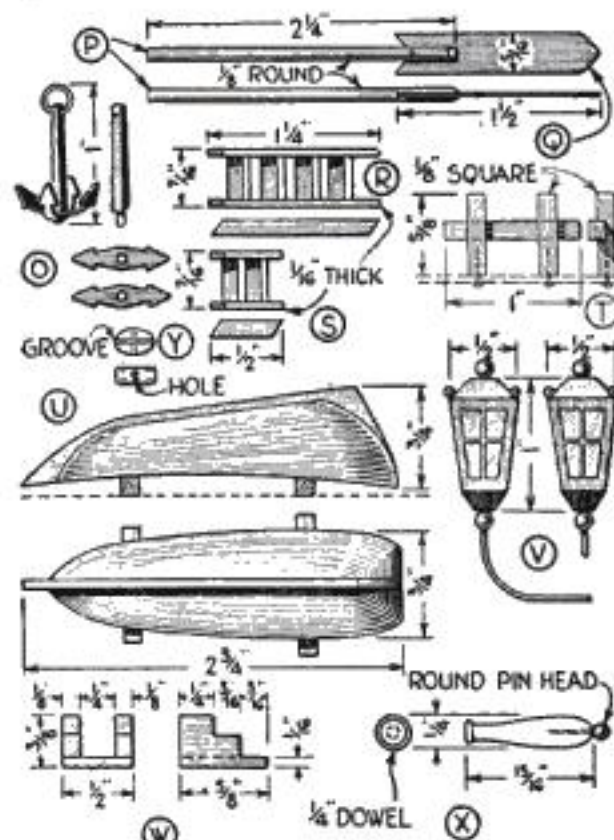
A flagpole with truck about $3\frac{3}{4}$ in. long and tapering from $\frac{1}{8}$ in. thick will be wanted right astern. It slants out from a hole in the center piece, resting against the sternboard. The flag, when prepared, is fixed by setting the truck down on the halyard holding the flag.

Twenty oars are needed. The looms or handles of these are of $\frac{1}{8}$ in. dowel stick, the top end slightly tapered to fit in the holes and the lower ends slit for $\frac{1}{2}$ in. down the center with the fretsaw. Into these slits go the blades, which are of thin pressboard, slightly pointed (see Q).

Bitts are needed for the anchor cable. They are made from three pieces as shown at T in the diagram.

The anchor can be of bronze or easily made from sheet lead (a piece of old water pipe split open). The long shank is a square rod of lead cut to a smaller square at the lower end. On this fit the flukes in pairs (it is grapnel shape). Each pair has a square hole to fit on the end of the shank, which is hammered over them (see O).

The top end is flattened and has a hole in it, in which goes a ring. For a cable I used a piece of green silk cord; this goes from the ring of the anchor around the bitts, the end being glued under the fore-castle.



BOW CHASERS ARE OF THE SAME DESIGN BUT ONE-HALF LARGER THAN W AND X

Details of the oars, anchor, ladders, bitts, lanterns, caique, guns, and pulley blocks

The model has a small winged serpent on the extreme tip of the deck. Some such ornament was usual, and a serpent seems suitable for a pirate ship. It is cut from lead, gilded, and fastened with two nails.

A small staple in the deck about 2 in. from the bow is required for the fore tack. It is an ordinary pin bent over.

(Continued on page 118)

"There's One You Won't Break"

THE STAR SPECIAL FLEXIBLE BLADE



This Hack Saw Blade will eliminate the great waste through breakage.

Practically unbreakable, both as to blade and teeth and is recommended for the toughest work.

"Star" blades have gained a prestige and reputation through their record of performance.

Let us send you samples of the blade Free.

®

Makers Since 1883.



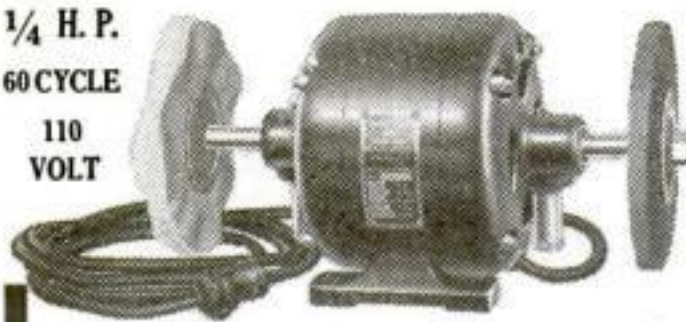
STAR HACK SAW BLADES

CLEMSON BROS., INC.

MIDDLETOWN, N. Y.

1/4 H. P.
60 CYCLE

110
VOLT



This Convenient and Compact BUFFER AND GRINDER

Complete as Illustrated

ONLY \$22⁵⁰ CASH
WITH
ORDER

Motor has extra size bunting bronze bearings with grease cups and filling cap. A 10 ft. cord with plug to fit any lamp socket included. Emery wheel and buffer are 6 inches in diameter, 1/2 inch thick. Emery wheel will sharpen tools quickly without burning. Shaft threaded to take a standard Jacobs Chuck for drilling purposes. **Guaranteed to give perfect satisfaction or money refunded less return charges.** Write for descriptive circulars and attractive price list on our complete line of Constant and Variable speed, single and three-phase Motors. All sizes. Squirrel Cage and Slip Ring types with many exclusive features, also **Martin Rotary Converters** for transforming AC to DC. We have a full line of rebuilt motors of all makes and sizes at bargain prices. Quantity discount on both new and rebuilt motors on request.

Northwestern Electric Co. Dept. 3, 420 S. Hoyne Ave., Chicago

BEFORE using Rutland Patching Plaster. It's easy to apply.



AFTER using Rutland Patching Plaster. Makes a perfect patch.

Cracked walls made good as new

YOU can make a permanent patch that will not crack, crumble or fall out, if you use Rutland Patching Plaster. It will not shrink as plaster of paris shrinks. You can paint or paper over it without shellacking and the patch will not "spot" through.

Anyone can use Rutland Patching Plaster and get perfect results. It comes in handy cartons all ready to use. Just add water and apply. Quick and handy!

Paint, wall-paper and hardware stores sell it. If your dealer hasn't it, mail coupon. We'll send you a 2 1/2 lb. carton and you can pay the postman 30c plus postage upon delivery. Rutland Fire Clay Co., Dept. R1, Rutland, Vt.

A few of its
many other uses

Mending outside stucco or cement walls.
Pointing brick work.
Closing mouse or rat holes.
Sealing small cracks where insects or vermin enter.
As a mortar to hold loose tiles in bathroom walls or floors.



Rutland Patching Plaster

RUTLAND FIRE CLAY CO.
Dept. R1, Rutland, Vermont
Send me 2 1/2 lb. carton of Rutland Plaster.

Name.....
Address.....
My dealer's name.....



KESTER READY TO USE METAL MENDER The Household Solder

Here's why thousands use Kester Metal Mender. **Simple**—Requires Only Heat—Anyone can use it. **Safe**—No messy pots or dangerous acids. **Sure**—Genuine Solder makes firm metal joints. **Satisfactory**—Works equally well on light or heavy, old or new work. **Economical**—Saves many times its price. **Your Dealer Can Supply You**

Soldering Booklet
"It's a
Cinch to
Solder"
Upon
Request



CHICAGO SOLDER COMPANY
4201-316 Wrightwood Ave., Chicago, U.S.A.

LOFTIS BROS. & CO. FOSTER DIAMONDS WATCHES



DIAMOND IMPORTERS
We import Diamonds direct from Europe and sell direct by mail—a great saving to you. Our Diamonds are "quality" gems, blue white, perfect-cut, personally inspected by our expert buyers.

SEND FOR CATALOG

Over 2,000 Illustrations of Diamond-set Jewelry, Watches, Pearls, Mesh Bags, Silverware, etc. Sent prepaid for your Free Examination. **TERMS:** Goods delivered on first payment of one-tenth of purchase price; balance in equal amounts, payable weekly, semi-monthly, or monthly, as convenient. **Satisfaction Guaranteed or Money Refunded**

WEDDING RINGS
All Platinum, \$25 up. With Diamonds: Three Diamonds, \$45; five Diamonds, \$60; seven Diamonds, \$75; nine Diamonds, \$110; surrounded by Diamonds, \$225. Solid White or Green Gold, \$5 up.

NO. 16—Wrist Watch, Solid 18-k White Gold, 17-Jewels, guaranteed, \$27.50; 16 Jewels, 14-k, \$22.50.

Railroad Watches—Guaranteed to Pass Inspection
HAMILTON NO. 992, 21 Jewels, Adjusted to 5 Positions, Gold filled 25-Year Case \$55
ELGIN'S LATEST RAYMOND, 21 Jewels, 8 Adj. Runs 40 hours one winding. Gold filled 20-Yr. Case \$55
ILLINOIS "BUNN SPECIAL" 21 Jewels, Adjusted to 6 Positions. Gold filled 25-Year Case. \$50

LOFTIS THE NATIONAL JEWELERS
BROS. & CO. EST'D 1858 108 N. State St., Chicago, Ill. Stores in Leading Cities

RADIO FANS—Listen in on WHT every Tuesday night from 7 to 7:30, every Friday night from 10 to 10:30, central standard time. **Loftis Bros. & Co.'s hour of music.**

The Home Workshop

A Ship Model of Your Own

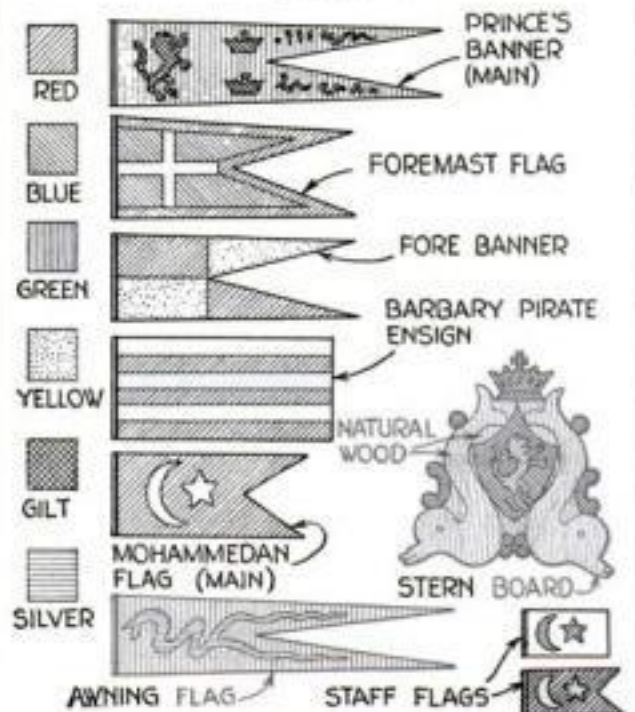
(Continued from page 110)

The quarter lanterns (the quarter refers to the sides of the ship near the stern) may be as elaborate as one fancies. Those shown (V) are blocks of wood 1 in. long tapering down from 1/2 to 3/8 in. They are beveled top and bottom and recessed where the glass would be; this is represented by tinfoil, painted a transparent blue.

Through the block is run a 3-in. long glass-headed pin that has been held previously in the gas until red to take out the temper. A large bead is threaded on the pin and the end is bent round to stick in the hull.

The flags and banners may be of paper, but thin white silk is better. It should be starched lightly with rice water and ironed; this prevents the paint's running and the silk's raveling.

The design of the flags should be drawn full size on blotting paper, or transferred



The flags, approximately one-fourth full size; detail showing coloring of stern board

from blueprint No. 45. The silk is pinned over this so that the pattern can be seen through. The painting is done with artist's water colors, and some gold and silver water-color paint, if desired.

For the flagstaff use the Barbary pirate flag of six stripes, white and red. The emblazoned banner at the main peak is an invented coat of arms; it has the African (not Scottish) lion of the princely captain, which is used on the sternboard and elsewhere on the ship, and it is green because he has been on a pilgrimage to Mecca. If your pirate captain has not been to Mecca, you may not use green anywhere.

The flag at the main is the Mohammedan white crescent and star on a red field, still used by Turkey. The fore pennant has red and yellow squares, once common in the Mediterranean, and that at the foremast is a fancy red, white, and blue banner. The flags are bent around the pins that serve as staffs and glued.

Glue one ladder to the poop deck at each side and the other forward near the center; glue down the hatches and the boat; glue the bottom and front of the gun

(Continued on page 114)

The Home Workshop

Homemade Play Car Has a Curious Bucking Motion

By JOHN SWINLAND

MY BOY Horace had broken his auto. His ever-recurring opportunities to "make something out of it" suggested to me one day that, indeed, some kind of vehicle could be constructed from the wreckage. From then on for a few weeks most of my spare time was spent in the basement of my home in Duluth, and the evening's work often became so absorbing that it carried me far into the night.

Our first contraption was on the jack-knifing principle and resembled in a way the one shown here, but it had no reach or gears. By the use of pawls or dogs on the wheels to prevent backward motion, we succeeded in making the thing go ahead, but only like a "grassworm," the front and rear parts moving alternately.

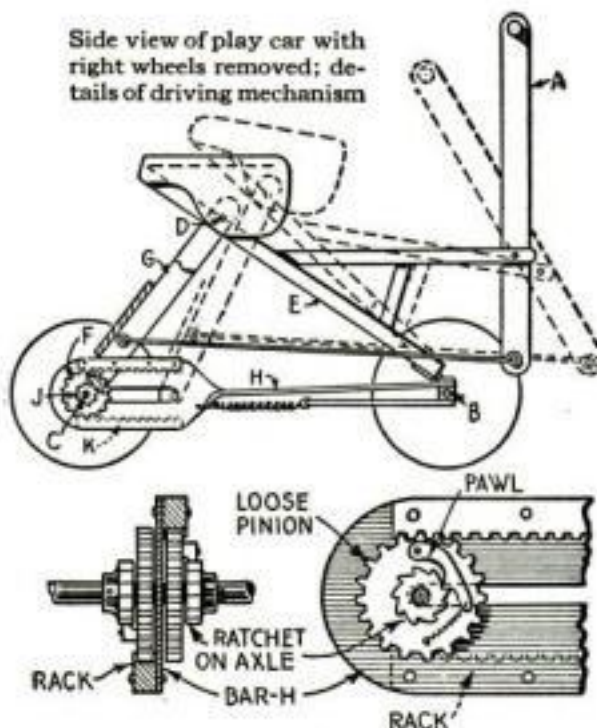
For outside use Horace and his sister, Maurine, wanted more speed and a steady motion. It took much time and hard study to figure out how to make this animal buck and still go forward steadily, but I finally succeeded in devising the car illustrated.

The car, operated by a lever *A* in the hands of the rider, has a forward motion and a peculiar rising and falling, or horse-back action, that delights the child and is interesting and fascinating to the spectator.

The main frame members (*E* and *G*) are hinged at the front and rear to the axles (*B* and *C*), as well as just under the seat at *D*. A slotted steel bar, *H*, serves to tie the axles together, and, as will be explained, provides the forward motion.

Referring to the diagram, it will be seen that pulling on the lever *A* will draw the rear frame *G*, the rear axle, and the wheels toward the front axle, thereby causing the other parts to assume the positions shown by the dotted lines. This action revolves the left-hand pinion, for

it is in mesh with the rack *K* riveted to the bar *H* on the lower left-hand side. Through the medium of a pawl and a ratchet on the same side, the axle is turned, propelling the whole vehicle forward about seven feet.



While this is taking place, the pinion on the right-hand side of the bar *H* has been revolving backward, being in mesh with the rack above it, and since it is fitted with a ratchet and pawl like the first pinion, it turns freely on the axle. But as soon as the pressure is released from the lever *A*, the weight of the rider tends to make the rear axle move backward in relation to the front axle, which brings into engagement the pinion and pawl on the right-hand side, causing another forward impulse to the car, while the left-hand pinion turns freely backward on the axle.

Thus one pull of the operating lever and its return to the starting point sends the car forward nearly 15 feet and humps the "animal" in a manner that is certain to captivate any child.

The front axle is pivoted in the center and has foot rests to provide for steering. A spring holds the front wheels to a straight course. While coasting the lever is stationary.

A LENGTH of discarded bicycle chain or any other chain that has flat side links, will provide a supply of neat repair plates for mending furniture, toys, and other articles. The plate may be let in flush with the surface of the wood easily by boring two holes and chiseling out the space between.



This unique vehicle opens and closes, and bucks the rider up and down as it speeds forward

To Help You Get Better Radio Reception

A New Radio Club to Study the Weather

YOU are invited to join a newly organized club to study the relations between radio reception and the weather. There are no dues and no assessments. This new organization is the Storm-O-Guide Club. All readers of POPULAR SCIENCE MONTHLY are eligible.

A thousand charter members in all parts of the country are wanted to help in a nation-wide semi-scientific study to determine the effect of weather conditions on radio reception.

It is hoped that through thousands of individual observations, the study of these individual observations when assembled at Club Headquarters and the free exchange of ideas among its members, the underlying causes for atmospheric interference with good reception will be discovered.

Everybody interested in radio will find the study of weather a fascinating hobby—a hobby that will undoubtedly lead to better all-round radio reception as well as being a material aid in getting greater distance.

Preliminary observations have indicated that when radio signals cross regions of different atmospheric pressure DX reception is better than when the signals parallel pressure lines. Whether or not more extensive and thorough investigation will prove the correctness of this preliminary observation is one of the scores of questions that can be settled only by the active, intelligent co-operation of radio fans throughout the country.

STORM-O-GUIDE CLUB

BELOW you will find an Application for Membership in the Storm-O-Guide Club. If you wish to be a Charter Member of this new club fill in and mail the application blank today. Remember there are no dues and no assessments. Joining the club puts you under absolutely no obligations. The Storm-O-Guide Club is purely a co-operative organization for promoting better radio reception. You are invited to

Join To-day!

Application for Membership in the STORM-O-GUIDE Club

Secretary, Storm-O-Guide Club,
Taylor Instrument Companies,
125 Ames St., Rochester, N. Y.

PLEASE enter my name as a Charter Member in the Storm-O-Guide Club. I have filled in below the information asked for. This application is made on the understanding that there will be no dues or assessments and that I am placed under absolutely no obligations.

Signed.....

Address.....

Name of Set.....

Circuit.....

No. of
Tubes.....

Every Handy Man needs SMOOTH-ON NO. 1

SMOOTH-ON No. 1 hardens like iron and expands in doing so to make cracked, open or loose parts everlastingly tight.



Don't pay any professional fixer a big price to make such repairs. With Smooth-On No. 1, you yourself can do a perfect job for a few cents and usually in a few minutes.

Get the Smooth-On habit and you will quickly find that it keeps many dollars in your own pocket. Try it on the following and see for yourself:

IN THE HOME

Stopping leaks in steam, water, gas, oil or stove pipes, mending cracks, breaks or leaks in furnaces and boilers, radiators, tanks, sinks, pots and pails, making loose handles tight on umbrellas, knives, hammers, brushes, drawers, etc., tightening loose screws, hooks, locks, door knobs, etc.

ON THE AUTOMOBILE

Making bursted water jackets and pumps good as new, stopping leaks in radiator, hose connections, gas tank and gas, oil and exhaust lines, making a fume-proof joint between exhaust pipe and tonneau heater, tightening loose headlight posts, keeping grease cups, hub caps and nuts from loosening and falling off, etc.

To get perfect results, write to us for and use the Smooth-On Repair Book. Free if you return the coupon.

Get Smooth-On No. 1 in 7 oz., 1-lb. or 5-lb. tins at any hardware store or if necessary direct from us.

Smooth-On Mfg. Co.
Dept. 58, 574 Communipaw Ave.
JERSEY CITY, N. J.



Write for
FREE BOOK



Do it with SMOOTH-ON

SMOOTH-ON MFG. CO., Dept. 58,
574 Communipaw Ave., Jersey City, N. J.
Please send the free Smooth-On Repair Book.

Name.....

Address.....

P. M.....

**Return this coupon for a
FREE copy of Booklet**

The Home Workshop

A Ship Model of Your Own

(Continued from page 112)

carriages so that they help stiffen the bulwarks. Glue the under side of the guns, poke the muzzles through the ports, raising the latter slightly above the horizontal. Then glue the two guns on the forecastle, so that the muzzles point over the rail. These had better have been painted first—the guns gold and the carriages black.

Now put the masts in place and set up the rigging. For this I used two parts of crochet silk, twisted together. Tie the middle of a length to the top of each mast; bring the ends down over the bulwarks to one of the holes previously bored. Glue the end of a toothpick and use it to push the thread in the hole; tap home with a light hammer and break off when dry.

Lash the yards with the sails on them to the masts about 1 1/2 in. from the top. You will now have to make 12 little blocks or pulleys (Y) from wood or sections of a celluloid knitting needle. They should not be more than 3/16 in. long.

The running gear that holds the sails in position is clearly shown on page 80. The yards should point slightly across the vessel.

Glue the ends of the oars and put them in position with the blades sloping very slightly up to the front, so that if they caught the water they would lift.

The awning over the poop can be of any beautiful material that is handy. In the present model it is blue with a design that resembles silver embroidery, and it is edged with a scarlet cord. It is a little more than 1 in. wider than the poop deck and 1/4 in. longer, to allow it to hang down at the sides.

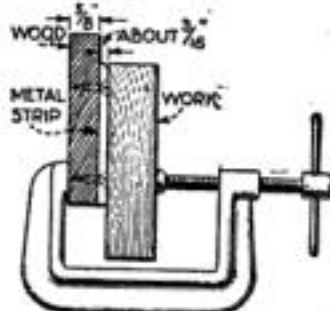
In front the awning is stitched to three long belt pins, which are driven into the main deck. The pins may be long enough to carry flags atop. Two shorter pins support the awning halfway along, and two more, right astern. If a thread is fastened to the front center pole and to the flag-staff it will help support the awning.

Put the lanterns in position and hang the anchor over the bulwark just abaft the fore rigging and your model is ready to start out on its mantle-shelf voyage of endless romance and adventure.

Aleikoom Salaam!
(Peace be with you.)

Gage for Planing Edges

PLANING long edges perfectly straight with a small plane, such as a common block plane, may be made easier for the beginner in woodwork by the use of a gage or templet. A wood or metal straightedge 1/8 or 3/8 in. thick is screwed to the face of a strip of wood so as to form a shoulder. This guides the bottom of the small plane without damaging the cutting iron.—HENRY JERVEY.



AMPLION

**Product of
38 Years'
Experience**

**"Brings in instruments
lost in other speakers"**

"I have listened to many loud speakers, but never to any music which can compare with that reproduced by the Amplion. The sound is clear, sweet and well modulated. It brings in clearly instruments in bands and orchestras that were lost in other speakers. Through my Amplion I enjoy my radio to a degree I had never thought possible."

You will be as appreciative as this gentleman, once you hear your set through an Amplion. Creation of the originators and oldest makers of loud speaking devices—Alfred Graham & Co., London, England—The Amplion leads in popularity throughout the world.

Enjoy an Amplion demonstration at your dealer's. Six models, including phonograph units, equipped with cords and panel plugs, \$12 up. Write for the "Amplion Pedigree."

**THE AMPLION CORPORATION
OF AMERICA**

Suite M 280 Madison Ave., New York City
Chicago Branch: 27-29 N. Morgan St.
Burndept of Canada, Ltd., Toronto

Prices Reduced On All Standard Make TYPEWRITERS



Lowest Prices in Years
We will ship any make you choose for one week's trial! Underwood, Royal, L. C. Smith, Remington, Oliver, etc.

Easy Terms Pay less than rent each month and own a typewriter. Guaranteed as good as new. Perfectly rebuilt by experts—the famous "Young Process." Send for our free trial offer and new low price list now. **WRITE TODAY.**

Young Typewriter Co.
World's Largest Dealers in Standard Typewriters
654 W. Randolph St., Dept. 1423, Chicago, Ill.

The Home Workshop

"Storm the Castle" Is an Easily Made Game for Children

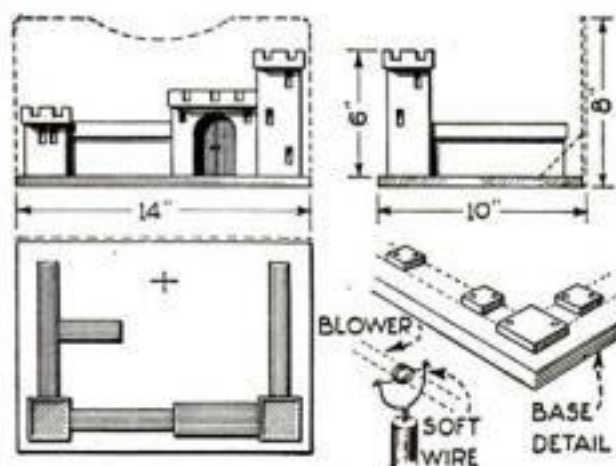


VISIONS of knights in armor and many thrilling story-book tales are conjured up by this realistic battle game, "Storming the Castle."

It is played on a table with ammunition shot from pea blowers. Each blower is set up in the center of a castle made as illustrated. Ten men, which are really 1-in. lengths of $\frac{5}{16}$ -in. wooden dowels, are set up on the castle battlements. The ammunition consists of 12 wooden pellets $\frac{1}{2}$ in. long and of a diameter to fit the blower tubes freely.

The towers, which are constructed of cigar-box wood in separate units, have no bottoms, but are set over blocks on the base, as detailed. A cardboard backstop is provided to prevent loss of ammunition.

A good color scheme is to paint the base dark gray, the walls and towers light



Front, side, and plan views of the castle and details of the base and pea-blower holder

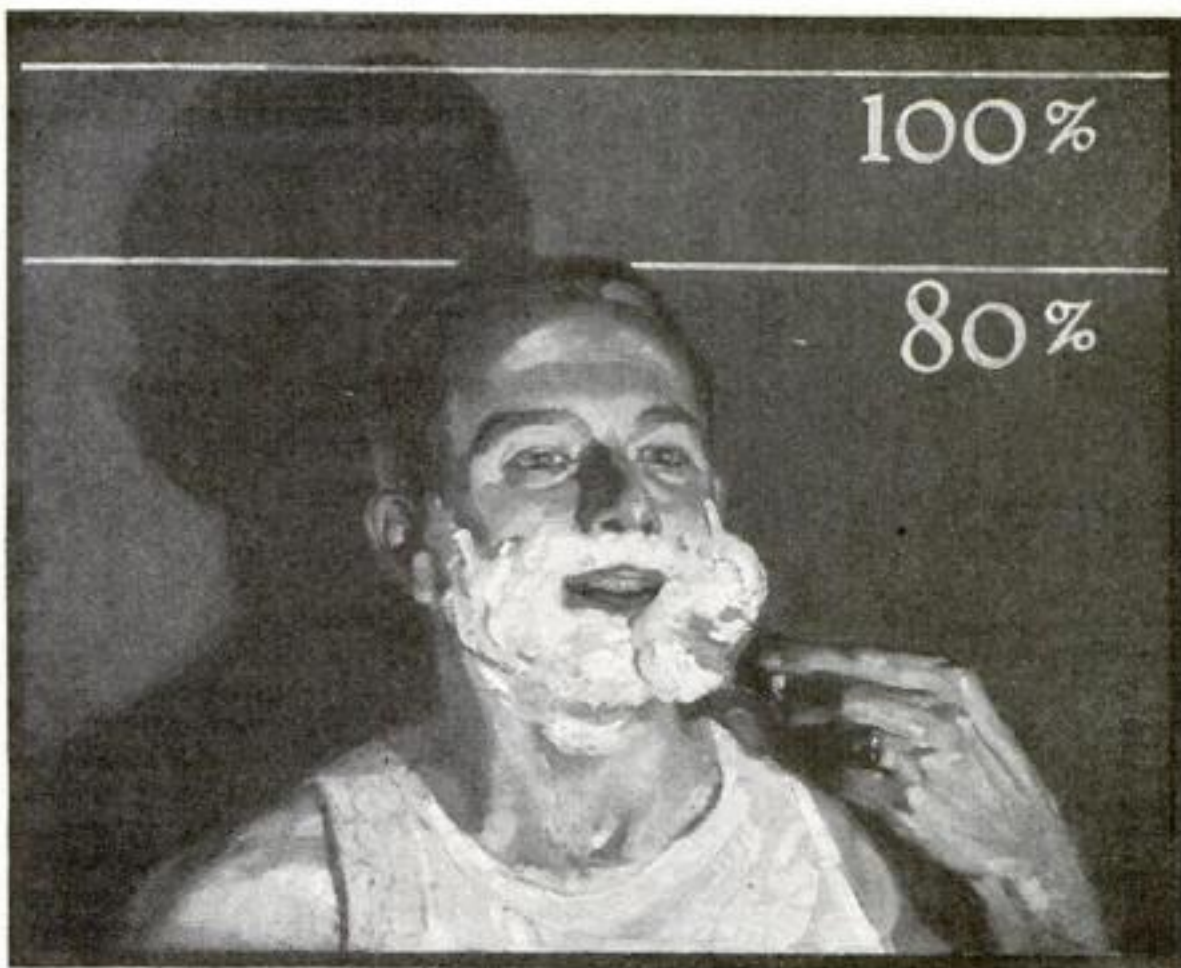
brown, the trim and gates dark brown, and the backstop light blue.

The blower itself is mounted so that it can be turned in any direction upon a dowel stick. To load, tip the mouthpiece downward and slide a pellet into the front end.

The game consists of three innings of four pellets each, and the winner is the one who knocks over the larger number of "men."—DONALD W. CLARK.

Combined Gas and Coal Stove

TO FASTEN a gas plate to an ordinary coal range, obtain two lengths of $\frac{1}{4}$ -in. pipe or $\frac{3}{8}$ -in. rods 2 ft. long, two $\frac{3}{4}$ -in. pipe straps, and eight 1-in.-long stove bolts. Remove the extension shelf on the range, take the legs off the gas plate, and attach the gas plate with pipe straps where the shelf has been removed. Then flatten and drill the ends of the $\frac{1}{4}$ -in. pipe or rods so that they can be used as brackets extending from the front leg holes in gas plate to the side of the range well above the floor.—DR. H. J. BLAKE.



We win 80 out of every 100 men to this unique creation

Say the Word

and we'll send you a 10-day tube of this unique shaving cream to try

(NOTE COUPON BELOW)

GENTLEMEN:—

The way we win new customers to Palmolive Shaving Cream is by giving men a 10-day tube to try.

In less than 5 years we've gained high place in that way.

95% of the men answering our ads are wedded to other makes of shaving preparations. Yet we win 80 out of every 100 to this unique creation.

It's different from any other shaving cream known. 60 years of soap study stand behind it. We tried out 130 different formulas in perfecting it.

It embodies the four great essentials 1000 men told us they wanted in a shaving cream, plus a fifth—strong bubbles—that we ourselves found and added.

To add the final touch to shaving luxury, we have created Palmolive After Shaving Talc—especially for men. Doesn't show. Leaves the skin smooth and fresh, and gives that well-groomed look. Try the sample we are sending free with the tube of Shaving Cream. There are new delights here for every man who shaves. Please let us prove them to you. Clip coupon now.

5 Important Features

You'll find it superior in at least five major ways

- 1—Multiplies itself in lather 250 times.
- 2—Softens the beard in one minute.
- 3—Maintains its creamy fullness for 10 minutes on the face.
- 4—Strong bubbles hold the hair erect for cutting.
- 5—Fine after effects due to palm and olive oil content.

Find Out

What we tell you is based on what we as expert soapmakers know. Our toilet soap, Palmolive, is the leading toilet soap of the world.

Now in courtesy to us, will you accept a test of our shaving cream; give us the opportunity to prove the claims millions make for it?



10 SHAVES FREE
and a can of Palmolive After Shaving Talc

Simply insert your name and address and mail to Dept. B-1134, The Palmolive Company (Del. Corp.), 3702 Iron Street, Chicago, Ill. Residents of Wisconsin should address The Palmolive Company (Wis. Corp.), Milwaukee, Wis.



C. J. MUSSEHL, Pioneer Artist on the Musical Saw, has taught thousands to become Experts, Vaudeville Stars and High-Priced Entertainers.

I'll Loan You the SAW 5 Days Free

Be Popular—Play for Money or Fun



JUST to prove how quick and easy you can learn to play a saw, I'll send you a genuine professional, specially tempered **Musical Saw** for 5 days trial. I guarantee that in 24 hours you can play tunes like "Old Black Joe," "Home Sweet Home," etc. Then you quickly learn latest jazz and song hits, operatic and classical music. Amazingly Simple and Easy. You don't need to know a thing about music.

Thousands Successful by My Methods

I have taught thousands to play the Musical Saw. Many of my pupils are on the Vaudeville Stage, playing in dance orchestras, making big money as entertainers. Mail coupon and let me prove that you, too, can quickly play like a professional.

Sweetest Music You Ever Heard

The Musical Saw has only one rival—the violin—for sweetness and mellowness of tone. And think of your popularity and social prestige when you can play this peerless instrument! Always in demand at parties and entertainments of all kinds.

Phonograph Record FREE



Double-disc, demonstration-size phonograph record of two beautiful "Musical Saw" selections. Enclose 10c (stamps or coin) to cover handling and postage. You'll wonder that a saw can produce such marvelous music. But the record proves it. Mail

coupon and check both spaces if you want the record. Let me show you letters from pupils who are now stage celebrities.

MUSSEHL & WESTPHAL
264 West Water St. Fort Atkinson, Wis.

C. J. Mussehl, Pres., Mussehl & Westphal,
264 West Water St., Ft. Atkinson, Wis.

Without obligation to me, send me, postpaid:
() Full particulars about FREE TRIAL OFFER
() Phonograph Record. (Send 10c to cover handling and postage if you want record).

Name.....
Address.....
Town & State.....

The Home Workshop

How to Hang a Door

(Continued from page 84)

with one end at an end line, and scratch the other end (Fig. 2). Lastly, gage for the depth of the hinge mortise—the thickness of the hinge, or about $\frac{1}{8}$ in.

Now, with a wide (or butt) chisel and mallet (you can use the side of your hammer head if you have no mallet) score deep cuts the full width of the mortise (Fig. 3). Be careful to avoid cutting too deeply. Start near the center and work toward the ends, or cut out a section near each end, remembering that the chisel crushes the wood back for a little distance. In this way the depression can be trimmed exactly to the line.

Undercut the mortise a trifle, since most hinges are beveled and can be slipped in from the side, dovetail fashion. In trimming out the chips, hold the chisel horizontally, left hand on the blade, right on the handle, with the fingers of the left hand acting as a gage to prevent splitting off the wood at the far side, beyond the hinge. If the latter happens, glue the splinter in place by laying over it a piece



Fig. 6. Marking around the lock plate for a mortise

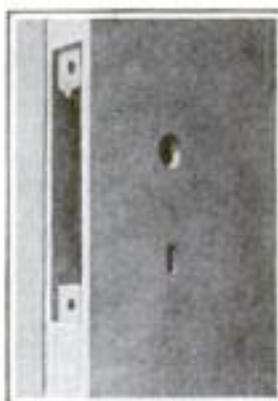


Fig. 7. How the lock mortise will look when finished

of paper and a block. This block can be tacked down temporarily with brads to hold it firm.

The hinges fitted, slip the halves into place and drill screw holes. Apply wax or soap on the screws, drive them in a short distance with the hammer, and sink them home with a screwdriver.

To "dap" for the jamb halves, gage as for the door, except that the width should be $\frac{1}{16}$ in. less, to allow for clearance for the stop. If a butt gage is used, the stop may be used as a guide, provided it is already in place, as the gage automatically allows for clearance.

If, when hinged, the door strikes on the lock stile, set the hinges a little deeper, or shim the inside edges with cardboard, which will make them draw the door close to the jamb. Conversely, shims placed outside the screws between jamb and hinge relieve hinge binding.

Cut off the bottom to give a clearance of $\frac{1}{2}$ in., so that the door will open over carpet or rugs, and sand the edges smooth, rounding the corners very slightly.

In the final fitting, work with fine shavings, remembering that it is much easier to take off stock than to add it.

To fit the average inside door lock, open the door halfway and drive a wedge under the bottom to hold it steady. Three feet up from the finished floor draw a

(Continued on page 117)

Relieve rheumatic pain!



Absorbine, Jr. attacks the area of congestion. It awakens the sluggish circulation. It brings prompt relaxation and relief from acute pain.

Absorbine, Jr. is agreeable to use. It may be applied freely—it cannot burn. It is ordinarily stainless. Its pungent, agreeable odor quickly disappears.

Have the magic bottle ever ready for many regular toilet uses and as first aid in emergencies.

At all druggists', \$1.25, or postpaid

Send for free trial bottle

W. F. YOUNG, Inc.
Springfield, Mass.

Absorbine Jr.
THE ANTISEPTIC LINIMENT



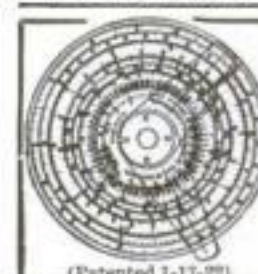
New! LA TWIN MOTOR FOR ROWBOATS

The sensation of the year. Offering new advanced features in Power, Speed, Control, Weight and Performance. For example—

NEW—Super-Power Twin Motor—At normal speed develops 3.85 H. P. (Brake Test). In racing trim develops 4.65 H. P.

- NEW—Under-water Stream-Line Design
- Cuts the water like a knife
- NEW—Giant Drive Propeller
- Gives flashing speed
- NEW—"Safety Propeller"
- Protects Boat, Boaters and Motor
- NEW—Super-charged Water Pump
- Insures a cool motor always at all speeds and reverse
- NEW—Combination Propeller and Rudder
- Steers WITHOUT A RUDDER!
- NEW—Unit Control Carburetor
- One easy adjustment for all speeds and weathers
- NEW—"Top-Spin" Easy Starter with big Elmsman Magneto
- Gets you away in a flash
- NEW—Combination Racing and Trolling Control
- One throttle lever for all speeds
- NEW—Lifetime Guarantee
- Against all defects in material and workmanship
- NEW—Five Days' Trial Offer
- Gives you a chance to match with any other Motor

WRITE FOR FREE CATALOG FOLDER TODAY (1)
LOCKWOOD-ASH
— MOTOR — COMPANY —
617 Jackson St. Jackson, Mich.



The Midget "Five-in-One" Slide Rule is a combination Mannheim, Polymetric, Log-Log, Binary, Add and Subtract Slide Rule. It will instantly add, subtract, multiply and divide any combination of whole numbers, fractions, mixed numbers and decimals. Gives every root and power, also Logs, Sines and Tangents. Made of aluminum with scales on white celluloid. Size 4 in. Approved and adopted by colleges. Price with instructions, \$1.50. Leather Case 50c extra. Sent C. O. D. if desired. Catalogue Free. GILSON SLIDE RULE CO., Niles, Mich.



GEARS All Kinds—Small

The most accurate made and prices reasonable. We carry a complete line of gears in stock for immediate shipment. Can also quote on special gears of all kinds. Send us your inquiries.

Write for Catalogue 214
CHICAGO STOCK GEAR WORKS
105 South Jefferson Street Chicago

The Home Workshop

How to Hang a Door

(Continued from page 116)

light pencil line across one side of the stile. Now hold the lock against the stile so that the spindle hole is on the line and the front plate is flush with the stile edge. Mark the position of the keyhole and knob with an awl (Fig. 5). Slip the front flange over the door edge in order to locate the ends of the mortise for the lock.

If the escutcheon plates act as key plates and knob roses, bore keyhole and knob spindle hole with a $\frac{3}{4}$ -in. bit, cutting in from one side until the spur pricks through the opposite, and finishing from that side. If individual roses and key escutcheons are used, bore the spindle hole with a $\frac{1}{2}$ -in. bit and the keyhole with a $\frac{3}{8}$ -in. bit, cutting out the straight lower part of the latter with a $\frac{1}{4}$ -in. chisel.

Gage a center line for the mortise, and with a $\frac{3}{4}$ -in. bit bore five holes centering on the line. The end holes also are centered on the end lines. Use a wide chisel to trim out the mortise until the lock slips in freely. Insert the lock, slip in the spindle, and put in the front plate screws. Then use the plate as a templet for marking the boundary of what is to be its own shallow mortise (Fig. 6). Remove lock and chisel out the wood until the plate will fit in flush (Fig. 7). Screw the lock in and put on the escutcheons or the knob spindle roses and keyhole plates.

CLOSE the door until the bolts touch the jambs and mark top and bottom of each with a pencil. Open the door, gage a pencil line as far back from the edge of the jamb as the inside edge of the lock front, and screw the keeper in place, observing the bolt marks on the jamb. Trace around with a knife, remove and dap in flush. Bore out the mortises for the bolts last of all.

This method varies somewhat from the usual practice of carpenters, but the home mechanic will find it well adapted to his particular needs.

Before painting or varnishing, remove the lock and keeper.

In many cases the lock, as it comes from the hardware store, has the beveled face of the catch bolt facing the wrong way. Lay the lock on a bench and take out the plate screws. Lift the side plate off carefully to avoid loosening the parts, then take out the latch bolt (Fig. 4), turn it over, and replace the cover.

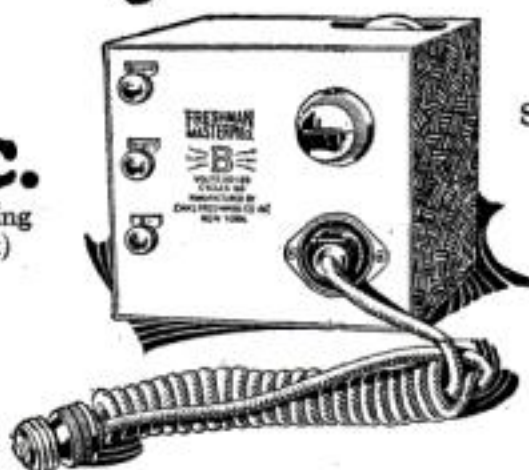
The concluding article in the attic room series will appear next month. It will pay you to preserve the entire series, which began in September, 1925, for the wealth of woodworking information it contains.

Lining a Stove Firebox

AS A lining for fireboxes in stoves, I have found three parts of common dry clay thoroughly pulverized and mixed with one part of Portland cement to be excellent. The powder should be made into a thick paste by adding water.—F.W.W.

YOU don't need "B" Batteries if you use the FRESHMAN MASTER "B" Battery Eliminator

FOR
A. C.
(Alternating
Current)



SIX INCHES
SQUARE
WEIGHS
7 POUNDS

This marvelous device absolutely eliminates "B" batteries

With the Freshman Master "B" Eliminator your set will always be supplied with constant and uniform power. Noiseless in operation; your reception will not be marred by the snap and crackle due to chemical action in "B" batteries.

The list price of the A. C. Model Freshman Master "B" Eliminator is \$20.00. However, a tube is required to rectify the alternating current into the required direct current for radio operation. And, as we desire to furnish the best rectifying tube that is obtainable, in our opinion, Freshman Master "B" Eliminators for alternating current are now furnished with R. C. A. Rectron UX-216-B Tubes.

**FRESHMAN
MASTER "B"
ELIMINATOR,
R.C.A. Rectron
UX-216-B Tube**

\$27.50

Sold by Authorized FRESHMAN Dealers Only

Write for 24-page illustrated booklet, full
of useful information for all radio fans.

CHAS. FRESHMAN CO., INC. Freshman Building, New York
2626 W. Washington Blvd., Chicago



"Good Bye, Boys!"

"To-day I dropped in for a last word with the boys at the office. And as I saw Tom and Dave there at the same old desk it came to me suddenly that they had been there just so the day I came with the firm four years ago.

"When I started here I was put at a desk and given certain routine things to do. But after a few months I began to realize that I was nothing but a human machine and that I couldn't expect to advance that way.

"So I wrote to Scranton and arranged for a spare-time study course that would give me special training for our work. Why, do you know, it gave me a whole new interest in our business? In a few months I was given more responsibility and more money. Since then I've had three increases, six months ago I was put in charge of my department, and now my big chance has come—I'm to be manager of our Western branch at \$5000 a year! It just shows what spare-time training will do."

If you want to make more money, show your employer you're trying to be worth more money. If you want a bigger job, show him you're willing to prepare for it.

There's a simple, easy way to do it. For 34 years the International Correspondence Schools have been training men and women right in their own homes whenever they had a little time to spare. Thousands of men and women have stepped up in just this way. More than 180,000 are studying now. Ten thousand are starting every month.

Can you afford to let another priceless hour pass without finding out what the I. C. S. can do for you? Here is all we ask—without cost, without obligation, mark and mail this coupon.

INTERNATIONAL CORRESPONDENCE SCHOOLS

Box 7682-D, Scranton, Penna.

Oldest and largest correspondence schools in the world

Without cost, please tell me how I can qualify for the position or in the subject before which I have marked an X:

BUSINESS TRAINING COURSES

- | | |
|---|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish | <input type="checkbox"/> Illustrating |
| <input type="checkbox"/> French | |

TECHNICAL AND INDUSTRIAL COURSES

- | | |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineer | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Gas Engine Operating | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Automobile Work |
| <input type="checkbox"/> Metallurgy | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Mining | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering | <input type="checkbox"/> Radio |
| | <input type="checkbox"/> Mathematics |

Name..... 6-26-25

Street.....

Address.....

City..... State.....

Occupation.....

If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

Magnified 225 Diameters

This is what the tip of a fly's leg is like when seen through the

ULTRALENS MICROSCOPE

Any amateur can immediately start using his Ultralens to examine the edge of a razor, the mesh of a cotton shirt, the bacteria in dirty water. No technical training required, yet hundreds of scientists and teachers are using this instrument. Gives enormous magnification and perfect definition. Send \$7.50 for complete outfit. Send for descriptive literature.



\$7.50 for Complete Outfit Prepaid
SCIENTIFIC APPARATUS CORP.
Dept. 207 Milton, Pa.

The Home Workshop

Overhauling a Ford Rear Axle

By RAY F. KUNS

Author, "Automotive Trade Training"

HOW to block a Ford car when it is desired to "pull" the rear axle is indicated in Fig. 1. By placing the blocks under the runningboard, the axle may be removed and replaced with comparative ease.

Unless the car is blocked unusually high, it will be necessary to remove at least one of the wheels. If both wheels are removed, the axle will slide to the rear, after the spring shackles, brakes, and ball socket have been loosened. If only one wheel is pulled, the axle assembly may be pulled to the side and then backward.

Pulling wheels in most cases is the difficult part of an axle overhaul. The

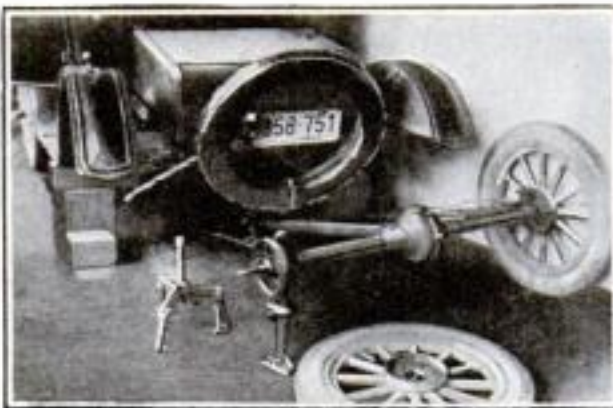


Fig. 1. How the car should be blocked so as to allow the rear axle to be moved to the rear

owner may not have kept the castellated nuts on the ends of the axles tight and the wheel hubs may be loose on the axle shaft taper, but in many instances they are very tight, or "frozen," as it is called.

Small wheel pullers that screw on the hub in place of the hub cap will remove a tight wheel hub, but they may not stand the pull required for the removal of a frozen wheel hub. A puller on the order of the one shown in Fig. 2 is required for this work. Spring plates are laid back of the wheel spokes and an adjustable wrench is used to place tension on the screw, which is centered on the shaft end.

While one operator turns the screw, another strikes a sharp blow on the end of the screw with a sledge hammer. Care must be taken in this operation, as the wheel may be damaged by too much pressure or the axle may easily be injured by too much pounding.

A scheme frequently resorted to by garagemen in troublesome cases of frozen wheel hubs is to loosen the castellated nut on the end of the shaft about one turn, reinsert the cotter key, and then take the car for a short, hard run. Driving over



Fig. 2. Removing a badly "frozen" wheel

(Continued on page 119)



Better Than a Windshield Wiper—Clear Vision Through the Entire Windshield.



It's Dangerous and Nerve Racking to Drive "Blindfolded" Like This.

STANDARD SALES CO. DEPT. A-52, MEMPHIS, TENN.
Manufacturers and Distributors Automotive Products

Clear-Tone TO

Clear Your Skin
Your skin can be quickly cleared of Pimples, Blackheads, Acne Eruptions on the face or body, Barbers Itch and Eczema, Enlarged Pores, Oily or Shiny Skin. CLEAR-TONE has been Tried, Tested and Proven its merits in over 100,000 test cases.

FREE WRITE TODAY for my FREE Booklet—"A CLEAR-TONE SKIN"—telling how I cured myself after being afflicted for fifteen years.
E. S. GIVENS 531 Chemical Bldg. Kansas City, Mo.

BLANK CARTRIDGE PISTOL

Protection Against Burglars, Tramps and Dogs

PRICES
50c.
\$1.00
POST-PAID
Well made and effective; modeled on latest type of Revolver; appearance alone is enough to scare a burglar. When loaded it may be as effective as a real revolver without danger to life. It takes standard .22 Cal. Blank Cartridges obtainable everywhere. Price 50c. Superior quality \$1.00 Postpaid. Blank Cartridges, by express, 50c per 100.
Johnson Smith & Co. Dept. 494, Racine, Wis

STUDENTS ART
Now ART and LIFE. Publishes each art assignments, lessons and articles on Cartooning, Designing, Poster work, Lettering, Chalk-talking, etc. Beautiful rotogravure prints, animals, scenery etc. Clean, interesting, helpful. For Art and Nature students. Satisfaction or money refunded. **CUT THIS OUT** send with \$1 now for 4 Mo. Trial Sub. or 6 Big Back Issues. Art and Life, Dept. 2654, Kalamazoo, Mich.

Diesel Engines Marine and Stationary

By ENSIGN DAVID L. JONES, U. S. Navy

The most complete, thoroughly practical and up-to-date treatise on the Diesel Engine ever published. It explains their construction troubles, remedies, operation and adjustments, practical trials and tests and the elementary thermodynamics of all types of the Diesel Engine. The book is fully illustrated with drawings of working parts and detail engravings. 400 pages.

Price, \$5.00

Popular Science Monthly
250 Fourth Avenue New York, N. Y.

Getting Ahead?

Read the advertisements on Pages 128 F to 158 this issue if you want to get ahead!

The Home Workshop

Overhauling a Rear Axle

(Continued from page 118)

rough streets sets up vibrations that ordinarily serve to loosen a frozen hub.

Recently a friend called me to say that he had broken a couple of good wheel pullers without freeing his wheels. After driving around the block once with the nuts loose, he had one wheel loose, but it required four circuits of the block to release the other.

Figure 3 shows the process of disassembling the axle. After the housings are separated and removed, the differential is disassembled. To remove the side gears, if it is necessary to replace the axle shafts, they first are driven toward the outer end of the shaft a bit and the split ring removed, after which they may be driven off toward the inner end. In garage practice a forcing press is used for this work; but if care is used the home mechanic can do it with a hammer and wooden blocks or by using a short piece of pipe for a drift.

A pin is used to hold the universal to the front end of the propeller shaft.

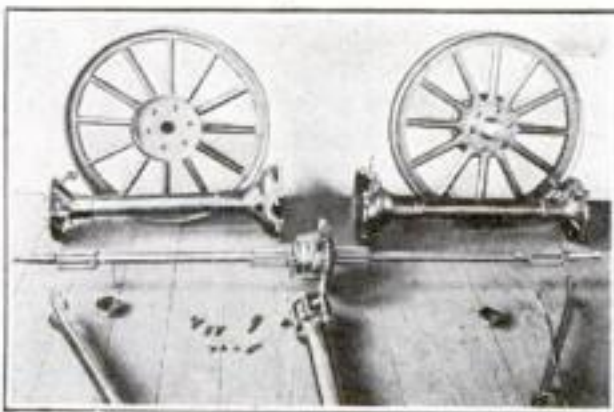


Fig. 3. After the axle has been disassembled, inspect each part for defects

Line this pin with the holes in the housing and use a drift punch to remove it.

Inspect all parts for wear or failure. The bearings supporting the outer ends of the rear axles carry a great load. When they are run without proper lubrication they will cut into the axle shafts. Worn shafts are subject to breakage and they create friction, which consumes power. The bearings are ground out and grease escapes into the brake drum, which may put the hand brake out of commission. In such a case it is useless to replace the felt-grease retainers, since the axle flops about in the bearings and pounds the felt out of shape, splashing the grease past it.

Another point where failure may occur is in the case of the ring and pinion gears. A small piece of steel from a broken gear tooth may lodge between two teeth of the ring gear and pass under the teeth of the pinion until they are badly chipped.

When replacing gears, make very certain they fit properly and are locked securely in position. The ring gear must lay in close contact with the differential carrier and the cap screws must have the heads carefully wired. The pinion shaft must be drawn into the taper of the propeller shaft to a snug seat, with key in place, and then be locked securely with the cotter key.

(Continued on page 120)



"Sorry —my dances are all taken"

NOT a dance with her! It spoiled his entire evening. Other men had dances with her, but he had none. It seemed odd that he was always "just too late." Or — was that her way of deliberately refusing to dance with him?

A great many young men are inclined to have a grimy-looking skin, spotted with blackheads and dull in appearance. Few realize that this hinders their success in life. Pompeian Massage Cream helps you overcome this handicap by giving you a clear, ruddy complexion.

Clears the skin. Pompeian Massage Cream thoroughly cleanses the pores. It helps clear up blackheads and pimples by stimulating healthy circulation, and by keeping the skin clean and the pores open.

Easy to use. After shaving or washing, rub it in gently. Continue rubbing and it rolls out, bringing with it all the dirt and skin impurities. Result — a clean, healthy skin with clear, glowing color.



Use Pompeian Massage Cream regularly at home — then you'll get the full benefit. At all druggists.

SPECIAL INTRODUCTORY OFFER

1/3 of 60c jar for 10c



For 10c we send a special Trial Jar containing one-third of regular 60c contents. Contains sufficient Pompeian Massage Cream to test thoroughly its wonderful benefits. Positively only one jar to a family on this exceptional offer.

THE POMPEIAN CO., Cleveland, O., Dept. 45

Gentlemen: I enclose a dime (10c) for 1/3 of a 60c jar of Pompeian Massage Cream

Name

Street Address

City State

Attention — set builders !!

When you build or rebuild—

it is actually amazing, what a marked difference in radio results is obtained with Sterling "Soft Tread" Rheostats and Sterling Microcondensers. To those who rebuild sets, and replace their present rheostat with a Sterling "Soft Tread" or add the Sterling balancing microcondenser to the circuit, the most highly successful reception is assured, other parts, of course being correct.

Sterling "Soft Tread" Rheostat

The smooth running contact shoe insures free yet noiseless movement in either direction. Enclosed in dust-protecting bakelite and polished nickel case. Requires the drilling of only one hole on panel for mounting.

Price, \$1.25

Sterling Microcondenser

No. R-311 and No. R-312

Two types, one the R-311 is invaluable for increasing the grid to plate capacity with 199 and 299 tubes and is extensively used for equalizing radio frequency circuits. The other, the R-312, is ideal for equalizing the capacity of imperfectly matched intermediate transformers and for single dial control. Adjustment is permanent and easily made.

R-311 Max. Capacity 5 Micro. Microfarads . . \$1.00
R-312 Max. Capacity 40 Micro. Microfarads . . 1.50

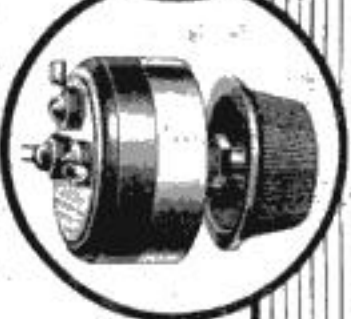
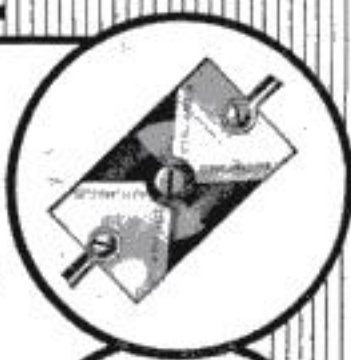
See your dealer or write for full description

The Sterling Mfg. Company

Cleveland, Ohio, Dept. V.

Sterling

RADIO PARTS

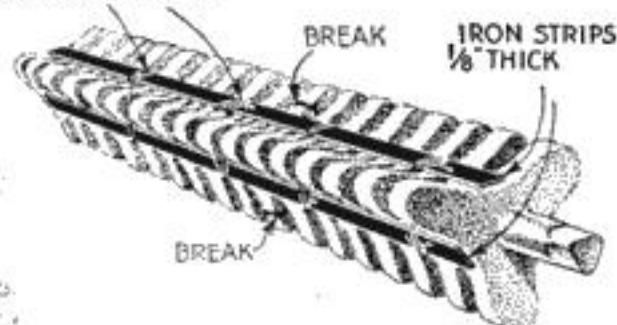


The Home Workshop

How to Repair Broken Furnace Grates in an Emergency

IN AN emergency a broken furnace grate often can be repaired by wiring three iron strips along the depressions as shown. The strips should be not less than $\frac{1}{8}$ by 1 in. in cross section and as

BINDING WIRES



The cracked grate is held together temporarily with three iron bars bound on with heavy wire

long as the grate. The wire should be $\frac{1}{16}$ in. in diameter or a little larger.

On one occasion I made use of this method in repairing a grate that remained in service for a surprising length of time and more recently I repaired another furnace in the same way. The need for some such method is due to delay often entailed in obtaining new grates from the manufacturer, especially if a furnace is of an old and perhaps discontinued model.—F. W. WILDER.

Overhauling a Rear Axle

(Continued from page 119)

When assembling the differential carrier and axle shaft in the axle housings, it is necessary to use special care. The ring gear is to the left of the pinion gear rather than to the right. In other words, it is toward the left side of the car or in the end of the left housing.

Strange as it may seem, it is not at all unusual to find rear axles assembled and rebuilt so that when the car is placed in low gear it travels backward, in reverse it travels forward, and in high it travels backward. Cars with two speeds in reverse are one of the garageman's standard jokes, yet the thing continues to happen.

Always use new thrust washers against the ends of the differential carrier in re-assembling a Ford axle. Make certain that the steel washers remain in position on the little dowel pins that keep them from turning. Cup grease on these parts will help the assembly.

New brake shoes in the wheel brake drums are always to be recommended if the car has seen considerable service. New bearings frequently are required and new gaskets always used.

When installing the job under the car, make certain of every point requiring any fastener such as pin, bolt, or nut. Where cotter pins are required, always insert them. Turn the hub locking nuts on the axle shaft up tight. Fill the housing with clean, fresh transmission or differential lubricant to the level of the filler plug. Drive the car a day or two and then re-tighten the nuts.

It also is well to go over all nuts and bolts after a few days and reset them. When carefully rebuilt in this way, the job ought to be good for a long period.

A Great Book Free with this pay-raising library

For a short time only we will give every subscriber to the New Library of Machine Shop Practice a copy of French's Engineering Drawing—the greatest book on mechanical drawing ever written. This book makes drawing as plain as day—tells you all about instruments, plans and methods—and prepares you to handle any drawing job you will ever have to do. It comes to you absolutely free with

Machine Shop Practice

9 Volumes — 3065 pages — 3608 Illustrations
(A combined home study course and reference library)

The New Machine Shop Library is written for practical men. It gives you the best methods for every kind of machine shop work. It explains machine tools and their operation, drawing and design, tool work, gears and grinding, jigs and fixtures, automatic screw machines and their tools and all of the mathematics you will ever have to use. It is plainly written, completely illustrated—the very best kind of help to the machine shop man who wants to advance himself.



FREE EXAMINATION COUPON

McGraw-Hill Book Co., Inc.,
370 Seventh Ave., New York.

Send me for 10 days' free examination the New Library of Machine Shop Practice. If satisfactory I will send you \$1.50 in 10 days and \$2.00 monthly until the special price of \$19.50 is paid. If not wanted, I will return the books at your expense.

On receipt of my first payment of \$1.50 it is understood that I am to receive, free of charge, a copy of the second edition of French's Engineering Drawing.

Signed.....
Address.....
City and State.....
Position.....
Employer.....



Let Your Face Be Your Guide

Why go on wondering about what Barbasol is like? Send 10c and get yourself the trial tube. Use Barbasol 3 times according to directions—and let your own face be the judge. We know your happy countenance will say, "Thank you for using Barbasol!"

— COUPON —

The Barbasol Co., Indianapolis, Ind.
I enclose 10c. Please send trial tube
and I'll give it a fair trial.

Name

Address

P. S. M. 3-26

Barbasol

For Modern Shaving

The Shipshape Home

How to Lay Roll Roofing

BECAUSE of its cheapness and apparent ease of application, composition

or "paper" roofing sold in rolls is used frequently by home owners, especially for porch roofs, garages, outbuildings and repair work of various kinds, and sometimes on the main house roof. Yet this type of roofing often is laid in such a way as to make it valueless in a few years.

It never should be placed over sheathing boards that are separated more than $\frac{1}{2}$ in. at the joints. The sheathing should be thoroughly seasoned so that it will remain firm and level at all times. All knot holes should be covered with pieces of tin or the knots nailed down tightly.

At the eaves a piece of iron bent as shown on the next page should be nailed to form a drip edge and to keep the roofing



Composition roofing may be put on from ridge down

in a firm position. This does away with the ragged, unsightly edge usually seen on paper roofs. Cement the roofing to the metal drip edge and then nail it along a line about $1\frac{1}{2}$ in. from the edge.

Roll roofing, wherever practical, should be laid the long way of the building instead of from ridge to eaves. A convenient method of laying it is to start at the top or ridge and lay downward toward the eaves. This is by far the best method, in my opinion, but seldom is used.

Nail cleats along the roof every 4 ft. from the eaves to within 3 ft. of the ridge. Measure the ridge and if the building is more than 30 ft. long, cut the roofing in several strips not more than 30 ft. each. If these strips are laid out flat in the sunlight for a time, they can be handled much easier on the roof.

Take enough strips to go the entire length of the ridge and lay them one at a time with about 4 in. lapping over the ridge. Reach over, fold this 4-in. overlap, and, starting in the middle of each sheet on the outside of the lapover, nail at 2-in. intervals. By nailing from the middle, all buckles are removed.

When the sheet is fast the entire length


(Continued on page 122)

THORDARSON

Super
TRANSFORMERS
Standard on majority of quality sets

*In sets priced
as high as
\$2000
you'll find
Thordarsons!*



 Is your radio set lacking in clearness and volume? To give it a tone quality comparable with that of the finest receiving instruments, replace the present audio frequency transformers with Thordarsons. Your dealer carries Thordarsons, identical with those used by nearly fifty leading manufacturers whose sets are priced as high as two thousand dollars each. Follow the lead of the leaders—amplify with Thordarsons. Write for interesting literature.



Types and Prices

Thordarson Super Audio Frequency Transformers, sub-panel or top mounting type: 2-1, \$5; 3 $\frac{1}{2}$ -1, \$4; 6-1, \$4.50. Thordarson Power Amplifying Transformers, \$13 pair. Thordarson Interstage Power Amplifying Transformers, \$8 each. Thordarson Auto-formers, \$5 each. All Thordarsons are unconditionally guaranteed. If dealer cannot supply, order from us.

THORDARSON ELECTRIC MANUFACTURING CO.
Transformer specialists since 1895
WORLD'S OLDEST AND LARGEST EXCLUSIVE TRANSFORMER MAKERS
Chicago, U.S.A.

ZENITH
KENNEDY
Radiodyne
Planstiehl
Howard
Thermodyne
OZARKA
Deresnadyne
ADLER-ROYAL
MURDOCK
MU-RAD
Valleytone
LEICH
Silver-Marshall
GLOBE
Knickerbocker
Newport
BUCKINGHAM
NUNN-LANDON
KUSTOMBILT
and many others
use Thordarsons

Also choice of the
MacMillan
Arctic
Expedition

SAVE $\frac{1}{3}$ TO $\frac{1}{2}$!
Everything in Radio
WRITE FOR CATALOG—FREE
RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

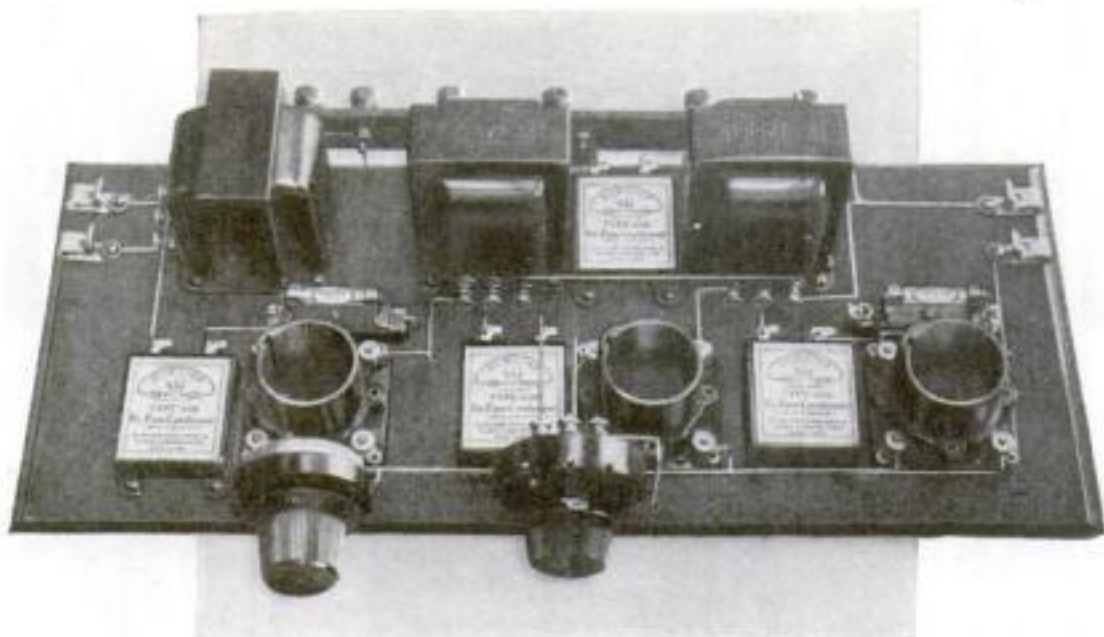


GERSTNER CASES
are GOOD Cases
Machinists, Toolmakers
and other particular
mechanics appreciate
their splendid quali-
ties. Catalog free.
Write for it today.
H. GERSTNER & SONS
527 Columbia St., Dayton, O.



A Genuine \$2.00 Knife for \$1.18 Postpaid
Handy shaped blade makes this knife best for mechanics, sportsmen and farmers; light but strong; resharpened easily. 52 size handle. German silver finish; blades file tested, hand forged from razor steel and warranted.

FACTORY PRICE
SAMPLE \$1.18
3 for \$3.00 POSTPAID
Send for our 100
page free list and
"HOW TO USE
A RAZOR"
MAHER & GROSS CO.
110 A. St. Toledo, O.
Established 1877



Distortionless Amplification

In impedance coupled Amplifiers (which evenly amplify all the notes in the musical scale) as well as in most of the latest developments in audio amplification, fixed condensers and grid leaks are essential elements of the hook-up.

Unless the accuracy and reliability of these parts is above question, the results from the unit will prove disappointing.

The set-builder who uses *Dubilier By-Pass Condensers* and the silent *Dubilier Metaleak* in constructing this unit, works with the assurance that comes from the use of parts whose performance has been tested and guaranteed by the best known manufacturer of condensers in the world.

Dubilier
CONDENSER AND RADIO CORPORATION

WITTE ENGINES

The ONE-PROFIT—Throttling Governor

THE STANDARD in cheap, dependable power—an all-purpose engine—yet so simple and trouble-proof a boy can operate it. Over 100,000 in use all over the world. Burns **KEROSENE, GASOLINE, GAS-OIL, DISTILLATE or GAS.**

Delivers big surplus power on any fuel—even speed on any load. Completely equipped with **WICO Magneto**, speed and power regulator and throttling governor. **WICO Magneto** This famous magneto assures easy starting in any temperature—sure performance in rain, snow or sleet. The most perfect system of high tension ignition known.

All Sizes—2 to 25 Horsepower.

\$5 DOWN up to 10 H-P. TERMS

FREE—Send for our latest Engine Book, or if interested, ask for our Log and Tree Saw, 3-in-1 Saw Riser or Pump Catalogs. No obligation.

WITTE ENGINE WORKS

2221 Witte Bldg. KANSAS CITY, MISSOURI. 2221 Empire Building, PITTSBURGH, PA.



Does Your Watch Tell Time in the Dark?



Ingersoll
RADIOLITES
Tell Time in the Dark

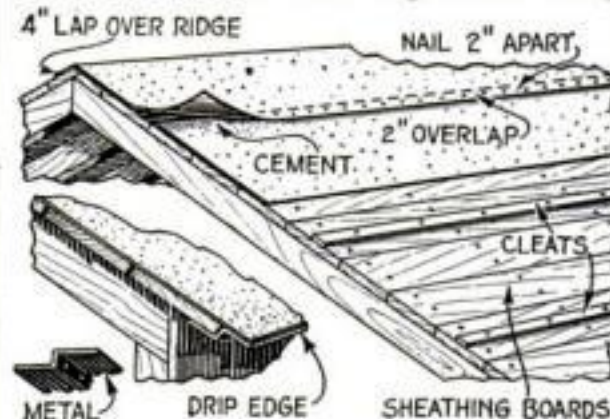
With a Radiolite under your pillow at night, you can find out the time almost without waking up.

Models \$2.75 to \$6.50.

The Shipshape Home

(Continued from page 121)

on the lapover, remove the first row of cleats at the top and lay the second row of paper in the following manner: First scribe on the roof boards with a pencil or a piece of chalk a line where the bottom of the top row of paper is to come. Measure up 2 in. from this and make a few marks as guides. Now throw the top layer of paper back, slide the next sheet to the marks and fasten it with a nail or two at the middle. Let the top sheet drop



Diagrams showing the principles of laying roll roofing and how to finish the lower edges

down, mark along its lower edge, raise it again, and cement carefully to this line. Then nail along the joint, starting as before from the middle. Lay all the sheets down to the eaves the same way.

You will find that the finished roof is without a buckle and that the seams are invisible from the ground. Furthermore, not a smear of cement will show and that is of great value on the mineral-surfaced, colored roofings used on dwellings. There will be no holes in the roof from walking or dragging material over it.

Chestnut or pine furring strips 1 by 2 in. are ideal for use as cleats on all but the steepest roofs.—CHARLES W. HUBERTZ.

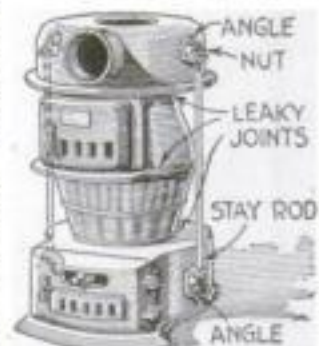
Reinforcing Furnace Joints

SOME so-called pipeless or one-pipe furnaces give more or less trouble

after they have been used for a while, because the cement that holds the sections together becomes loose and permits ashes, gas, and smoke to come up through the register into the living rooms. Often much damage is done in this way to draperies, furniture, and wallpaper.

This objection was overcome to a great extent in my own case by having four angle irons made at the local blacksmith shop. The irons were made to fit as nearly as possible the conformation of the top and bottom sections of the furnace, as indicated in the accompanying drawing.

Two long rods were threaded at each end like bolts. These were slipped through the holes in the free ends of the two pairs of angle irons, which were approximately in line. After the furnace joints had been well puttied with furnace



How to prevent gas leaks from a furnace

(Continued on page 123)

The Shipshape Home

(Continued from page 122)

or iron cement, the rods were bolted down with ordinary nuts and washers.

This simple device proved especially effective when coal was burned, as coal gas had given the most trouble.—
EUGENE L. GIESE.

Chain Supports a Paint Pot

IN PLACE of the time-honored wire hook, I find a chain is more convenient for fastening a paint can to the rung of a ladder. The chain should be 1 or 1½ ft. long, with a key ring at one end and a snap hook at the other. The advantages are that it seems to keep out of the way better, does not get lost so readily, and can be shortened or adjusted as necessary by passing more loops around the ladder rung.

The chain should be heavy enough to stand the weight of the paint can and a reasonable amount of rough usage.—
RICHARD C. TARR.

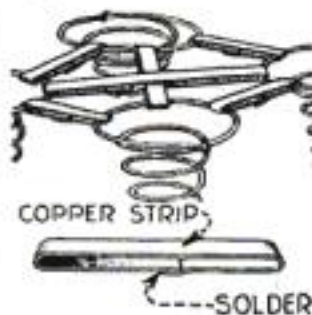


Repairing Window-Shades

WINDOW-SHADES sometimes are pulled down so violently that they are torn off the roller. When such an accident happens, take the time to run a line of liquid glue along the roller before tacking the shade back in place. Then spread more glue on the shade until one complete turn has been fastened securely to the roller. When the glue is dry, there will be little danger of the shade's being torn off, unless it is pulled so violently as to rip the cloth.

Fastening Chair Springs

AFTER a furniture repairman had ripped off the bottom of our overstuffed chairs on several occasions in order to retie the twine connecting the springs, I prevented further breaking by fastening the springs together with strips of sheet copper ½ in. thick and ¾ in. wide. The copper bands were looped around the springs as shown and soldered in place. The thin, flat metal gives slightly so that it can not be felt under the upholstery, and the repair has proved a lasting one.—
F. J. WILHELM.



Filler for Large Cracks

LARGE cracks and openings, especially in light woodwork, can be filled with a putty made of equal parts of corn starch, wheat flour, Japan drier, and linseed oil. Add color, if necessary, and allow the filler to dry before varnishing.

Years of experience are behind this radio battery



TWENTY years ago, when the automotive industry was in its infancy, Prest-O-Lite gave the motor-car its first dependable eyes. Today Prest-O-Lite Batteries, for radio and motor-cars, are sold by millions in all parts of the world, and there is always a Prest-O-Lite or radio dealer service station a few steps from your home.

Prest-O-Lite Radio Batteries were especially designed for radio in the world's largest electrochemical laboratories. In engineering, materials and workmanship nobody offers more than Prest-O-Lite. Prest-O-Lite Storage Batteries deliver their rated ampere-hour capacity at full power, thus lengthening the time between recharging and assuring good reception.

Prest-O-Lite Batteries are attractively priced from \$4.75 up. It is no longer necessary to take a chance on batteries of unknown make.

THE PREST-O-LITE CO., INC.
INDIANAPOLIS, IND.
New York San Francisco
In Canada: Prest-O-Lite Company
of Canada, Ltd., Toronto, Ontario

Send for free booklet

"What every owner of a radio should know about storage batteries" is a little booklet which every radio fan will find interesting and helpful. It is crammed full of hints that will bring surprising radio results—and save you money. It's yours for the asking—without obligation.



Designed especially for radio

Prest-O-Lite

STORAGE BATTERIES FOR
MOTOR-CARS AND RADIO



WADE BENCH LATHE



Cap. 4 in. dia. x 12 in. length. Slide rest has travel entire length of bed. Lead-screw inside bed. Hollow spindle. Turning, facing, boring, drilling, winding, thread cutting. No. 1 Lathe, plain headstock... \$58.00
No. 2 Lathe, back-gear headstock... \$58.00
Complete line of accessories at equally low prices. New Catalog sent free.
THE GEROLD COMPANY
Dept. P. S. 9, 120 Liberty Street, New York

1926 CATALOG JUST OUT!

SEND FOR YOUR COPY

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.

JUST OUT! GREEN, RED. SELLS FOR \$1.25. SAMPLE 67c



Unbreakable, TRIO Self-Filling Fountain Pens. Guaranteed for 2 Years. "It makes Carbon Copies." Money refunded if you do not think it is the best pen you ever wrote with. Finished in beautiful green, red, purple or black. Send for wholesale quantity price list and distributing plans.

F. SPORS & CO.,

198 4th Street,

Lesueur Center, Minn.



It Can't Corrode!
it's a
Belden Aerial

NO RADIO fan wants to put up an outdoor aerial more than once, if he can help it. That is why the experienced set owner installs a Belden Aerial.

Every strand of a Belden Aerial is carefully coated with baked Beldenamel to resist the corrosive action of atmospheric fumes and smoke. A bare copper aerial soon corrodes and becomes inefficient. A Belden Aerial lasts for years without deterioration.

Specify
Beldenamel
Aerial Wire



Install a permanent Beldenamel Aerial, sold in a distinctive striped carton, clearly labeled for your protection against substitutes. By using a 150-foot length, the aerial wire can be used as a lead-in without joints.

Belden

Send for Free Illustrated Booklet

Belden Manufacturing Company,
2304-K So. Western Ave., Chicago.

Please send me your latest illustrated booklet, free, describing Belden Radio Products and their use in Radio work.

Name

Address

NEW VEST POCKET ADDING MACHINE

Adds as rapidly and accurately as a \$300 machine, yet fits the vest pocket. Mechanically perfect. Easy to operate—nothing to get out of order. Everyone who uses figures should own one. Counts Up to 999,999,999

\$2.95

Total visible at all times. A pull of the finger clears it. Don't carry a pocket full of pencil stubs and scrap paper to do your figuring. Carry a Ve-Po-Ad.

10 Days Trial Send no money. Just name and address and we will send machine postpaid. Pay postman on delivery \$1.95. Use it for 10 days to prove it does all we claim. If not perfectly satisfied we will refund your money. Limited supply. Send order today. Reliable Adding Mach. Corp., Dept. 153, 184 W. Washington St., Chicago, Ill.

AGENTS

Better Shop Methods

Old Bill Says—

MR. "I DIDN'T THINK" has no business in a machine shop.

We all know that makeshifts are to be avoided whenever possible, but it is a poor mechanic who cannot devise one in an emergency or adapt himself to unusual circumstances.

Knowing the right speeds and feeds for your cutting tools is just as important in its way as knowing how to grind them.

I like workmen who come to the shop with the same enthusiasm they take to a baseball game.

Every machinist can read with keen appreciation and pleasure "A Yankee in King Arthur's Court," by Mark Twain.

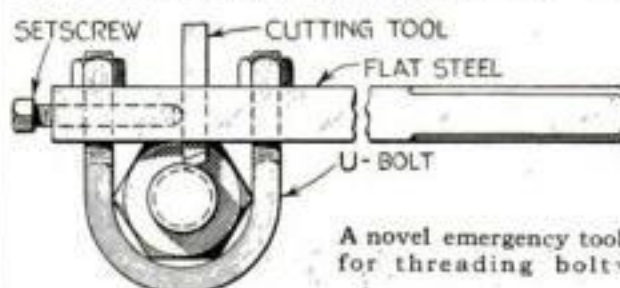
When turning work on centers in a lathe, never go away and leave your lathe running, for a center may get hot and be twisted off and then you will find your job on the floor when you return.

Men sometimes hesitate about coming to me with a question. It is no reflection on a mechanic's knowledge or ability to ask a question about such parts of the work as he does not thoroughly understand.

There is a right way and a wrong way to use a monkey wrench. The jaw opening should point in the direction of the pull on the wrench.

Improvised Threading Die

WHEN an erector was faced with the necessity of cutting longer threads on some foundation bolts already in place for an air compressor and could find no die of the proper size at hand, he in-



A novel emergency tool for threading bolts

geniously made the tool illustrated. It consists of a nut to give the proper lead, a flat bar of steel with a setscrew to hold a threading tool at one side of the nut, and a U-bolt for fastening the bar to the nut.—FRANK N. COAKLEY.



Old Bill, machine shop foreman

BIG NOVELTY BARGAIN! 10 Cts.

THROW YOUR VOICE
Into a trunk, under the bed or anywhere. Lots of Fun fooling the Teacher, Policeman or Friends. Barrels of Fun.

THE VENTRILO,
A little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Sent with full instructions; anyone can use it, NEVER FAILS. Also a 32 PAGE BOOK ON VENTRILOQUISM. Formula for Secret Writing, 12 Money Making Secrets and the marvelous

NOVELTY X-RAY WONDER
With it you can apparently see the bones in your fingers, lead in pencil, etc.; lots of fun with this outfit. Also 10 Big Magic Tricks Free with every order. All the above Novelties by prepaid mail for **10¢**

VENTRILO COMPANY
Dept. 307 Norwalk, Conn.
LARGEST and OLDEST Mail Order House in Connecticut.

"DON'T SHOUT"

"I hear you. I can hear now as well as any body. 'HOW?' With THE MORLEY PHONE. I've a pair in my ears now, but they are invisible. I would not know I had them in, myself, only that I hear all right."

The Morley Phone for the DEAF

is to the ears what glasses are to the eyes. Invisible, comfortable, weightless and harmless. Anyone can adjust it. Over one hundred thousand sold. Write for booklet and testimonials.

THE MORLEY CO., Dept. 797, 10 S. 18th Street, Philadelphia

DON'T WEAR A TRUSS

BE COMFORTABLE—
Wear the Brooks Appliance, the modern scientific invention which gives rupture sufferers immediate relief. It has no obnoxious springs or pads. Automatic Air Cushions bind and draw together the broken parts. No salves or plasters. Durable. Cheap. Sent on trial to prove its worth. Beware of imitations. Look for trade-mark bearing portrait and signature of C. E. Brooks which appears on every Appliance. None other genuine. Full information and booklet sent free in plain, sealed envelope.

BROOKS APPLIANCE CO., 230-B State St., Marshall, Mich.

Looks Like a Real AUTOMATIC

Protect yourself from toughs and hold-up men. Most amazing automatic 4 1/2 in. long; gun-metal finish. Can't tell from real automatic until you pull the trigger and presto you have Opera Glass, Reading Glass, Telescope, Binoculars, etc. Loads of fun; useful, instructive. A real protector. **Send No Money**

MAKES 10 USEFUL ARTICLES

Just send name. On arrival of "Automatic" deposit with Postman \$1.48 plus a few pennies postage. Satisfaction guaranteed or deposit refunded. Supply limited. Order now. Big Bargain Catalog sent FREE.

FERRY & CO., Dept. 1783, 3224 N. Halsted St., Chicago, Ill.



Tool Cases

for Machinists, Carpenters and Tool Makers; none better; thirty styles. Quartered oak and metal covered. Ask for booklet. "Built for Service"

The Pillod Lumber Co., Swanton, Ohio

AUTO INVENTIONS WANTED

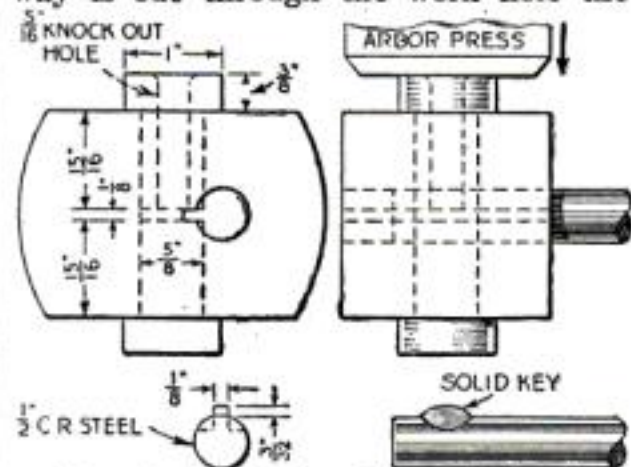
Long established manufacturer of auto accessories which are daily sold by practically all wholesale and retail accessory houses will consider manufacturing and distributing new automobile products, capable of equally wide sale through same channels. Patented articles preferred. Address Auto Accessory Manufacturer, Room 2104, 310 S. Michigan Ave. Chicago, Ill.

Better Shop Methods

Swaging a Solid Key on Cold Rolled Steel Shafts

A NOVEL method of swaging a key on a small shaft is illustrated below. This idea is suitable for certain classes of work in which the key is not required to have great strength, as in the mechanism of typewriters, adding machines, and other office appliances.

The tool steel die block has one hole to fit the shaft and another hole at right angles to the first for the punches. A key-way is cut through the work hole the



After the shaft has been inserted in the die block, two punches are used to form a solid key

same size as the key to be formed on the shaft. The top punch is pierced with a $\frac{5}{16}$ -in. hole, which is useful if it becomes necessary to knock out the bottom punch.

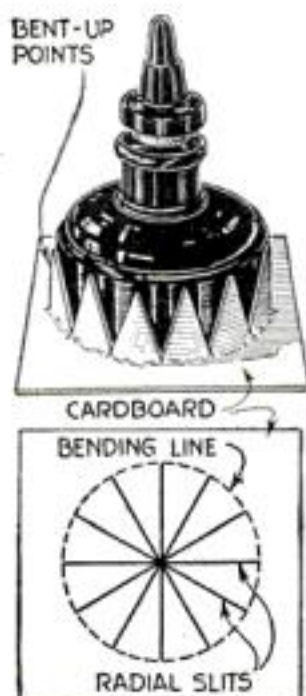
The work is placed in position in the die block, both punches are inserted, and pressure is applied by means of an arbor press. If the punches are made so carefully that the shoulder distances are exactly right for the thickness of the key, the work will not vary more than .001 in. in thickness. If a larger key is required, the shaft can be slid along in the hole and another key swaged in line with the first.

Cardboard Stand Prevents Ink Bottle from Tipping

ONLY a piece of cardboard 10 or 12 in. square and a rubber band are needed to make a safety stand for the draftsman's ink bottle.

Lay out a circle in the center of the cardboard the same diameter as the ink bottle. Then cut 10 equally spaced radial slits and bend the points upward. Press the board down over the bottle so that it rests firmly on the table, as shown at the right, and then snap a rubber band around the bottle near the bottom.

The bottle may be moved around without danger of its being tipped and the surface of the cardboard makes a convenient resting place for drafting tools.—H. L. W.

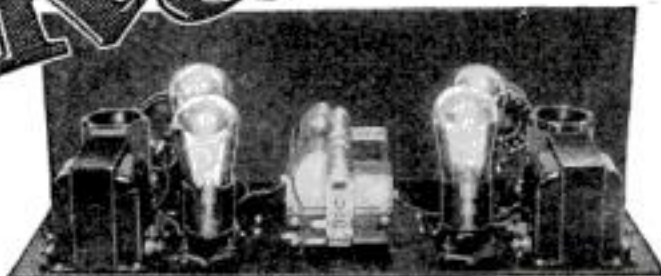


How the cardboard is cut, bent, and used

Send for this
New Hookup

Silver-Cockaday

Four Tube Receiver



Here is a new radio receiver sensation in which are combined the genius of McMurdo Silver and Laurence M. Cockaday. A receiver for the home builder that will represent for several seasons to come a far greater dollar for dollar value than any other design available.

No choicer group of radio products has ever been embodied in a single radio receiver. Not only are these manufacturers nationally known and accepted as the leaders in radio design and construction, but they have developed for the Silver-Cockaday receiver several new features which will create a new standard in reception throughout the radio world.

Contributing Manufacturers:

- Belden Mfg. Co.
S-C Wiring Harness
- Central Radio Laboratories
Centralab Resistance
- Polymet Mfg. Corporation
Fixed Condensers, Leak and Leak Clips
- Silver-Marshall, Inc.
Variable Condensers, Coil Sockets, Coils, Tube Sockets, Vernier Dial, Mounting Brackets
- Thordarson Electric Mfg. Co.
S-C Power Transformers
- Walart Electric & Mfg. Co.
[Continental Fibre Co.]
Drilled and Processed Front Panel and Drilled Sub-Panel
- Yaxley Mfg. Co.
Rheostat, Jacks, Switch

Startling New Features

SINGLE CONTROL—But one tuning or station selector control.

SELECTIVITY—In a residential district of New York City, within a few hundred yards of powerful stations, thirty-five stations were heard between 9 and 10 p. m. on the loud-speaker. KFI, in Los Angeles, was heard with ample volume to fill two rooms.

QUALITY—Two new-type Thordarson power amplifying transformers possessing a substantially flat frequency characteristic over the range of 40 to 6,000 cycles, give a superior quality of distortionless reproduction.

VOLUME—Exceeds that of other four-tube receivers, and equals that obtainable from standard five and six-tube receivers.

UNLIMITED WAVE LENGTH RANGE, through the use of interchangeable coils.

WIRING AND ASSEMBLY—All wiring is carried in special harness. Since each wire is exactly the right length, and has a special color, it is impossible to go wrong in wiring.

Over-all design, rugged and solid. Adapted to practically any standard cabinet, any standard tube, any battery or eliminator source of supply, outdoor antenna or loop. Full description of the receiver will be published in the March issue of Popular Radio.

Get the hand book at your nearest Radio Dealer or clip the coupon and send with 25 cents TO-DAY. Address

The S. C. Merchandising Committee
112 S. Wabash Ave.
Chicago

The S-C Merchandising Committee:
112 S. Wabash Ave., Chicago
Gentlemen: Please find enclosed 25c, for which send me hand book of the new Silver-Cockaday Receiver.

NAME _____

ADDRESS _____



SAY! LISTEN!

A NEW PAIR OF PANTS MATCHED TO YOUR COAT AND VEST. Just doubles the life of your suit. We can match almost any suit. 70,000 patterns. Sample is sent for your O. K. before making. All made to measure. Send piece of cloth or vest for matching.

ACME PANTS MATCHERS
Dept. C. 28 W. Jackson, Chicago

Enclose return postage if test is sent.

TYPEWRITER PRICES CUT
World's best makes—Underwood, Remington, Oliver—prices slashed to almost half.

\$2 and it's yours

All late models, completely rebuilt and re-finished brand new. GUARANTEED for ten years. Send no money—big FREE catalog shows actual machines in full colors. Get our direct-to-you easy payment plan and 10-day free trial offer. Limited time, so write today. International Typewriter Ex., 186 W. Lake St. Dept. 338, Chicago



ADDING MACHINE VEST POCKET SIZE

ADDS—SUBTRACTS—MULTIPLIES—DIVIDES

Does work of \$300 machine. Guaranteed 5 years. NOT A TOY.

Made of steel and indestructible. Million dollar capacity. Fits in pocket. Will not make mistakes. So simple child can operate it. Everybody should carry one for figuring.

BABY CALCULATOR CHICAGO U.S.A. PATENT APPLIED FOR

00000000

FREE TRIAL

Send No Money—Just name and address. We will ship Calculator immediately. On delivery pay postman \$2.50, plus few cents postage. If not satisfied after 10-day trial get your money back. THOUSANDS OF SATISFIED USERS.

This is the lowest priced practical Calculator made. Why pay more for inferior imitations? Order from this ad.

BABY CALCULATOR SALES CO.

P.O. Box 1118, Chicago, Ill., Dept. 32

Write for big commission and territory proposition.

AGENTS

Nestler Process is simplicity itself as demonstrated by the inventor, Emil Nestler, rubber expert and engineer. One step of 7 which comprise process here shown.



New Tires from Old

Amazing New Patented Process Fuses or Welds New, Tough, Durable Rubber Tread onto Worn Tires

CONCEIVE that of all methods present or past the Nestler Rubber Fusing Process alone produces a positive joint such as by fusing or welding between new and old rubber! The first and only practical and successful method of re-rubbing a tread worn tire is here at last—a simple, fast, inexpensive process that makes tires new again and cuts tire costs in half.

Think of the opportunity for this service right in your community! Right now the opportunity is exceptional on account of present tire costs. And all indications point to still higher prices for years to come due to an impending rubber famine. The result is a tremendously increased demand for Nestler Service.

Each year since 1917 thousands of worn tires have been successfully nestlerized by ourselves and those licensed by us under the basic Nestler Patent. We are now prepared to issue to men who qualify, a limited number of additional licenses. License rights will include protected territories and full cooperation from this company. Previous experience is unnecessary since licensees will receive thorough training without charge. We have demonstrated that any person of average intelligence can learn to operate the Nestler Process and the simplified Nestler Equipment in a few weeks' time. Investment for necessary Equipment only from about \$1000 upward, depending on production required for territory. Terms may be arranged.

The 34 million tires worn out annually, constitute a limitless opportunity for business and profit. With aggressiveness and the application of sound business methods, a Nestler Rubber Fusing Station yielding \$10,000, to \$20,000, or more yearly profits can easily be created.

The Nestler Plan tells how it can be done. It gives facts and figures in addition to a full description of the Nestler Rubber Fusing Process, Nestler Equipment and the way they work together. Choice territories are now going fast. If the bare outline of this proposition as given above is interesting to you, you are urged to write without delay.

Nestler Rubber Fusing Co., Inc.
Dept. SP—245 W. 55th Street
New York, N. Y.

Better Shop Methods

Lamp and Fuse Carrier for Shops and Large Buildings



FOR large buildings the lamp and fuse carrier illustrated saves time for whoever is charged with the task of keeping the electric lights in order. The actual cost of making it was \$1.10, and that was for the box corners and leather handle. The wood came from a packing case.

It was designed and made to aid in the work of replacing lamps in a hospital where the buildings are scattered over extensive grounds. Carrying the various sized lamps around in their original packing had been a nuisance and often resulted in breakage.—JAMES F. MAGEE.

General Utility Shop Clamps Made Quickly by Welding

THE new style of clamp illustrated is welded from pieces of scrap boiler tubing. It is strong enough to stand any strains to which it may be put.

In making it, a 1-in.-wide ring is cut from 2-in. boiler tubing and is flattened on the sides to an oval shape. A reinforcement made from a section of a similar ring is fitted snugly around one end of the oval, and the ends of this are oxyacetylene welded to the sides of the oval-shaped section.

A $\frac{1}{8}$ -in. hole is drilled through the top of this reinforced section and top of ring, then tapped for a set screw.

The shoe of the clamp is another piece of 1-in.-wide ring cut from boiler tubing, bent to fit, if necessary. A spot is countersunk in the top of the shoe to receive the point of the setscrew.—A. G. WIKOFF.



This powerful clamp serves many purposes

Selecting Babbitt Metal

BABBITT metal in the better grades is composed of tin, antimony, and copper in about the proportion of 88, 10, and 2 respectively, with no lead. The cheap grades contain only a small percentage of tin and antimony and rarely any copper; indeed, the bulk of the poorer varieties is chiefly lead. To insure reliability and endurance in a bearing, only the highest grade babbitt should be used. It costs more, but wears longer.



Buoyant, steady and graceful

THERE'S a joyousness—a sense of absolute freedom about canoeing that comes with no other sport. "What shall we do this summer?" is uppermost in the minds of thousands. Why not let an "Old Town Canoe" help answer the question for you?

You'll be mighty proud of your "Old Town." These canoes are patterned after actual Indian models. Graceful, sleek and fast, "Old Town Canoes" win the admiration of all who see them. Remarkably low in price too. \$64 up. From dealer or factory.

The 1926 catalog is beautifully illustrated with all models in full colors. Write for your free copy today. OLD TOWN CANOE CO., 1693 Middle St., Old Town, Maine.

"Old Town Canoes"

64 Illustrated Pages of Radio Bargains! Write for Catalog Today

RANDOLPH RADIO CORP.
159 N. UNION AV. Dept. 3 CHICAGO, ILL.



Print Your Own

Cards, stationery, labels, paper, circulars, tags, menus, book etc. Save money and time, cut cost in half. Sold direct from factory. Pays for itself in a short time. Complete Outfits, \$8.85 up. Job Press, \$12, \$35; Rotary \$150. Print for Others: Big Profits. All easy, rules sent. Write for catalog of presses, type, paper, cards, envelopes, paper cutters. The Press Co., E-33, Meriden, Conn.

BUCHSTEIN'S FIBRE LIMB

is soothing to your stump—strong, cool; neat, light. Easy payments.



Guaranteed 5 Years
Send for Catalog Today
P. BUCHSTEIN CO., 610-3rd Ave., So., Minneapolis, Minn.



Direct from Factory

\$39.00 buys this RACEABOUT torpedo body in gray prime for your Ford. Special hood and bullet nose shell.

Write for Catalogue

AMERICAN TOP & BODY CO.
Lake St. Delphi, Ind.



"LIGHTING FIXTURES"

Ready to hang. Direct from the manufacturer. Completely wired, including glassware. Send for New Catalogue No. 27 (Just reduced prices) Special proposition to Dealers **ERIE FIXTURE SUPPLY CO.** Desk A, Erie, Pa.

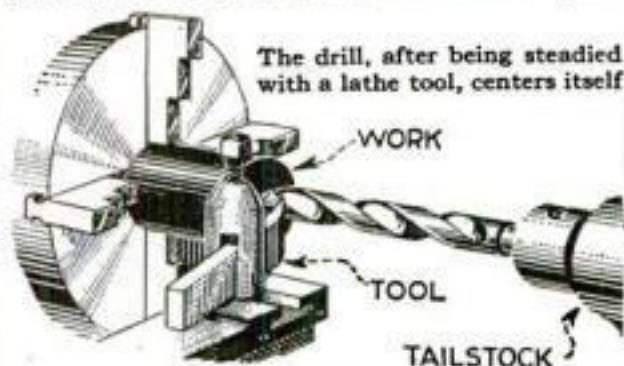
SEE the big Prize Offer on page 4 of this issue

Better Shop Methods

Drilling in the Lathe without Using a Centering Tool

SO SIMPLE a thing as drilling a hole in a piece of work held in a lathe chuck may be made even easier if the method illustrated is used. It is not even necessary to use a centering tool.

The drill is held in the tailstock spindle and advanced so that it almost touches the work. A tool of any kind is put in the toolpost with the point elevated somewhat so that a flat surface is pre-



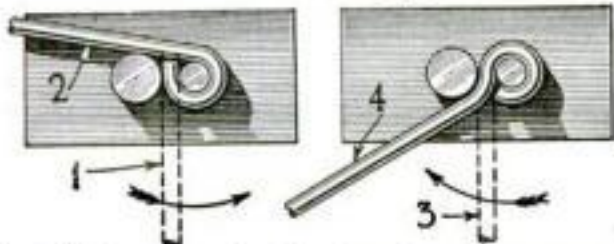
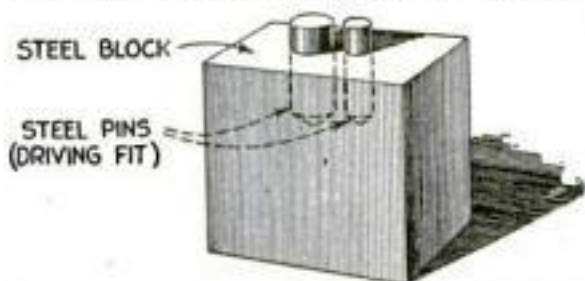
sented to the drill. The tool is run in until it touches the drill, which is slowly fed into the work.

If the drill wobbles, the tool is pushed a little harder against the drill, which soon centers itself. One caution has to be borne in mind: The drill must be cutting freely and without wobble before the lip is below the surface.

I have used this method for years and have never seen it fail. It requires little practice, and when mastered saves time.

When a taper shank drill is used in conjunction with a drill-holder, I start the drill with a heavy center punch mark near the center and proceed to true up the drill in the same way.—W. H.

Forming Small Eyes by Hand

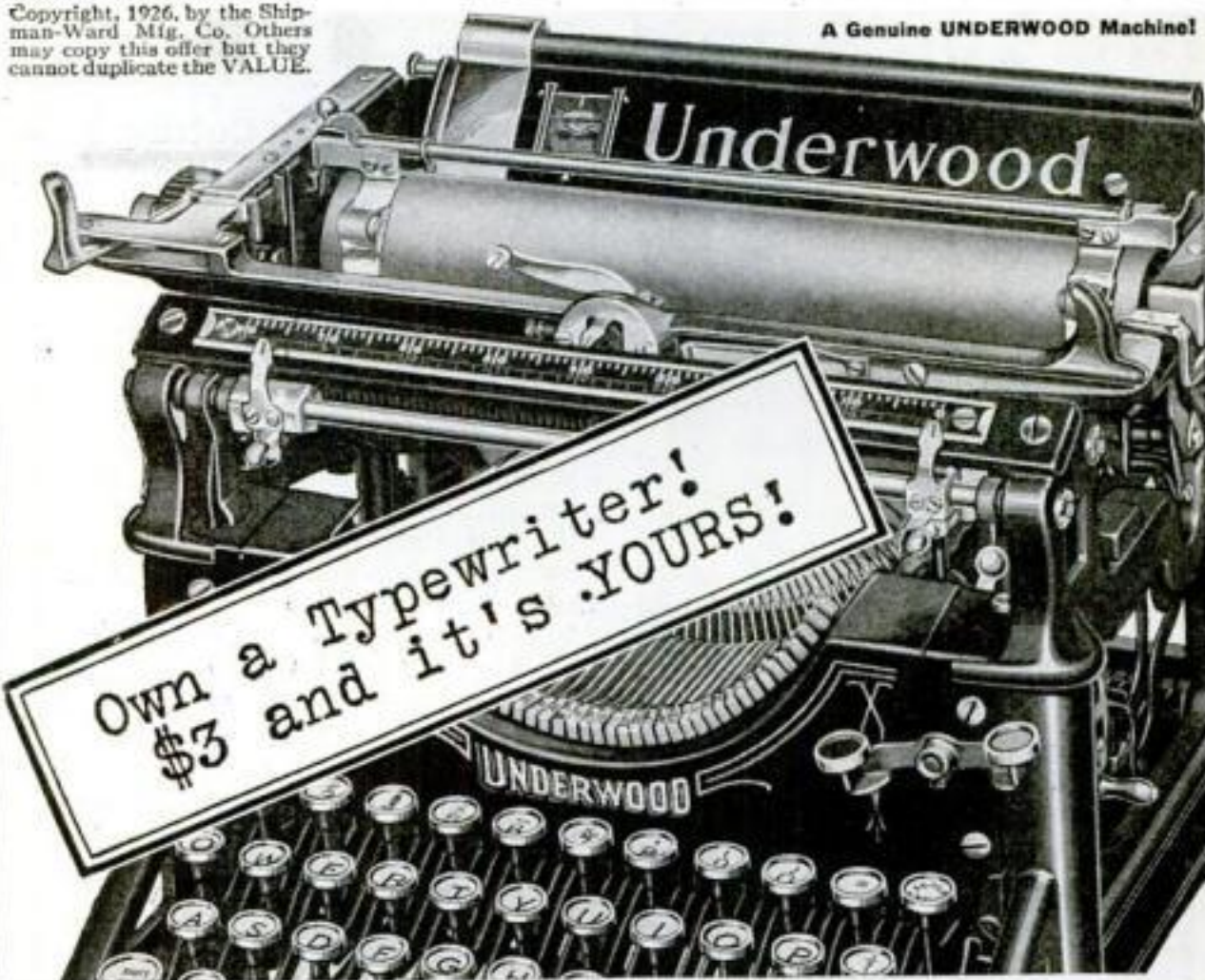


THE necessity for forming an eye on a number of rods so that the centers of the eye and rod would be in line led to the development of the device illustrated.

Two holes were drilled in a small block of steel; these were a driving fit for steel pins, one the size of the required eye, the other a little larger. The distance between was the thickness of the wire stock.

An eye was formed and centered by placing the stock in the first position and turning to the second, third, and fourth positions shown. The former was found to work equally well on round or flat stock, but when the flat stock is used, the pins must be as high as the stock is wide.—HAROLD N. WHITMORE, M.E.

Copyright, 1926, by the Shipman-Ward Mfg. Co. Others may copy this offer but they cannot duplicate the VALUE.



A Bargain You Can't Ignore!

A Standard Typewriter Is a Joy to Every Member of a Family!

GET YOUR typewriter now. A genuine, Shipman-Ward rebuilt Underwood—"the machine you will eventually buy." Don't send a cent, but do get our special offer—valuable book on typewriting—free. You can learn to write on this standard-keyboard Underwood in a day. In a week, you'll feel lost without it! The free trial will prove it. Our rebuilt plan gives you the best machine and a big saving.

Act NOW If Ever!

Speak up, if you want one! This Underwood is so popular this lot we're completing now won't be long in selling! Rebuilt from top to bottom—every single worn part replaced. New typewriters are guaranteed for a year; we guarantee this one five years! That's our Better-Than-New Guarantee. And we guarantee a big saving!

We don't want a penny now. Nor any money at all, unless this proves the typewriter bargain of your life. The trial is free. If you buy, our easy terms make it a pleasure to pay. There's no excuse now,

for not owning a typewriter—and the finest make! We include all tools, cover, etc., all complete, all ready to write. Write us now. Deal direct; we are the largest factory of the kind.

FREE! Get our catalog free; lowest prices and terms. A manual free, too; valuable instruction for learning rapid typing, useful pointers for all who use a typewriter, business forms, social correspondence, work for others, etc. Clip coupon now!



Mail to SHIPMAN-WARD MFG. CO.
2143 Shipman Bldg., Chicago

Please send FREE, full offer, catalog, typing manual, and outline your free course in Touch Typewriting, without obligation!

Name.....
St.....
P. O.....

FOR CLEAR, QUIET "B" POWER



RADIO Storage "B" Battery

12 Cells 24 Volts Lasts Indefinitely—Pays for Itself

Economy and performance unheard of before. Recharged at a negligible cost. Delivers unfailing power that is clear, pure and quiet. Approved and listed as standard by leading Radio Authorities, including Pop. Radio Laboratories, Pop. Sci. Inst. Standards, Radio News Lab., Letex, Inc., and other important institutions. Equipped with Solid Rubber Case, an insurance against acid and leakage. Extra heavy glass jars. Heavy rugged plates. Order yours today!

SEND NO MONEY Just state number of batteries wanted and we will ship day order is received. Extra offer: 4 batteries in series (96 volts), \$10.00. Pay expressman after examining batteries. 5 per cent discount for cash with order. Mail your order now!

WORLD BATTERY COMPANY
1219 So. Wabash Ave., Dept. 80 Chicago, Ill.
Makers of the Famous World Radio "A" Storage Battery
Prices: 6-volt, 100 Amp. \$11.50; 120 Amp. \$13.50; 140 Amp. \$14.00.
All equipped with Solid Rubber Case.

World STORAGE BATTERIES

Set your Radio Dial at 210 meters for the new 1000 watt World Storage Battery Station, WBSB, Chicago. Watch for announcements.

SEND NO MONEY

Genuine Full Cut Diamonds

Terms If Desired—6 Months to Pay. Outside U.S. Cash with Order

\$25



This Reg. Trade Mark guarantees you genuine diamonds.

No. 6596. Any initial (raised gold) or Eastern Star, Rebecca, Mason, Shrine, K. of C. emblem instead of initial if desired. Send number of ring, size of finger, initial or emblem desired and ring will be sent for inspection.

Ask for Free Catalog
Buffalo Jewelry Mfg. Co.
"The Mail-Order House"
Dept. A
601 Washington St., Buffalo, N. Y. White Gold.



Are You Afraid to Face the Truth About Yourself?

There are occasions in the life of every man when he realizes how miserably he has fallen below what others had expected of him and what he had dreamed for himself. The "big" man faces the truth, and does something about it. The "little" man finds an excuse for his failure, and does nothing. What are your answers when you ask yourself questions like these?

Am I not drifting
along aimlessly?

What, after all, is
my purpose in life?

Am I trusting too
much to chance to
bring me success?

What is my greatest
weak point?

Is it lack of will, poor
memory, mental
laziness, mind-wan-
dering, or what?

Am I "licked" by life,
am I a "quitter"?

What can I do, now,
to "find myself"?



How 550,000 People Have "Found" Themselves Through Pelmanism

Pelmanism is a scientific system of mind-training; it takes the well-established principles of psychology, simplifies them so that they can be understood by everybody, and arranges them into a really remarkable system, which is designed to re-arouse and to train certain mental faculties, which in most of us lie absolutely dormant and atrophied.

What It Has Done

Pelmanism originated in Great Britain. Members of the royal family, leading statesmen, distinguished military and naval officers, world-famous authors, artists, actors, editors and publicists, leaders in industry and finance, people of the highest distinction in the Empire—became just as enthusiastic Pelmanists as clerks and "tommyes" and day-laborers.

When the movement spread to America the same story was repeated—captains of industry and finance, men of affairs, jurists, writers, leading business men, professional people of all types—adopted Pelmanism as enthusiastically as wage-earners and college students. And now, over 550,000 people in every part of the world, men and women usually of the highest type of intelligence, have adopted and use Pelmanism to help them "find themselves."

Send for Free Book

When people like General Sir Robert Baden-Powell, Judge Ben B. Lindsey, Frank P. Walsh, Major General Sir Frederick Maurice, Admiral Lord Beresford, T. P. O'Connor, H. R. H. Prince Charles of Sweden, Jerome K. Jerome, George Lunn, Sir Harry Lauder and thousands of others equally famous find that there is "something in Pelmanism," can you afford to ignore its possibilities for you?

We will be glad to send you, without charge, a book called "Scientific Mind-Training." This tells the complete story of Pelmanism, what it is and what it does; it is filled with stories—some of them almost unbelievable—of people whose lives have been completely made over by Pelmanism. To send for this book involves you in no obligation.

The Pelman Institute of America
(Approved as a Correspondence School under the laws of the State of New York)

Suite 873, 19 W. 44th St., New York, N. Y.

The Pelman Institute of America,
19 W. 44th St., Suite 873, New York City.

I want you to show me what Pelmanism has actually done for over half a million people. Please send me your free book, "Scientific Mind-Training." This places me under no obligation whatever.

Name.....

Address.....

City..... State.....

Better Shop Methods

Old Bill Talks on Cutting Fluids

(Continued from page 76)

blood poisoning. For this reason it is important that any cooling medium used should possess some antiseptic properties in addition to its other desirable characteristics.

In this connection it is well to remember that the U. S. Health Service recommends the use of lanolin or equal parts of lanolin and castor oil as a preventive for oil acne. This should be rubbed on the hands and forearms after they have been washed thoroughly with warm water and soap. The lanolin, it has been found, is most effective when applied both in the morning and at noon.

The need for this treatment is indicated by the fact that the Public Health Service found that 27 per cent of machine-shop workers examined were suffering from this type of skin disease, which is caused by constant contact with cutting oils and compounds.

WHERE specific results are required, there is seldom any economy in mixing different oils and compounds, as they may be purchased properly mixed or compounded. While the process of mixing them is simple, it calls for special apparatus and care so that the various ingredients will not separate after being placed in use.

A good oil or compound for cutting purposes should contain a large proportion of fatty matter, for it is the fatty matter that gives the coolant the necessary strength to do its work. In fact, the fatty matter is the most valuable part of the coolant, if oils alone are used.

For carbon steel tools, pure lard oil or a good grade of mineral lard oil and a paraffin oil in about equal parts is satisfactory; the paraffin oil is used to reduce the cost.

A cheap drilling compound can be made by mixing 2 gal. of pure lard oil and 5 lbs. of washing soda with about 8 gal. of water. This can be mixed in a barrel or steel tank and should be boiled for about one hour by means of a steam hose submerged in the solution.

Turpentine or kerosene is recommended for drilling hard steel; soda water or mineral lard oil is suitable in most cases for drilling soft steel, wrought iron, or malleable iron. Brass, bronze, aluminum, and other soft alloys seldom require any lubrication for drilling, but when one is to be used, paraffin oil will give satisfaction.

There are many different formulas for mixing cooling oils and compounds for use with automatic screw machines and lathes. Kerosene, fuel oil, paraffin oil, ordinary machine oils, crude oils, red engine oil, sperm oil, and lard oil are some of the oils used. One or more of these often are mixed in varying proportions with soft soaps, washing soda, and water.

A GOOD coolant for milling and turning may be made by adding to 10 gal. of water 1 qt. of lard oil, 1 qt. of soft soap, and 1 lb. of washing soda. The soap and

(Continued on page 128A)

A Wonderful NEW Radio Invention

LIKE most great inventions this wonderful new radio development is as simple as A B C. When you see it you will wonder why it was not thought of before.

Stations you have never been able to get before are brought in with amazing ease. Never will it be necessary to hold your breath while fishing for distant stations.

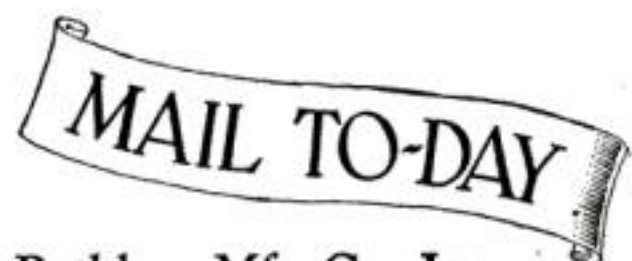
This new invention is dependable. It has been tested and approved by Popular Science Institute of Standards.

If you have an old set it will make it equal in simplified control, to the best of the new sets on the market. On most new sets it will improve tuning control 100%.

Whether a beginner or a "fan" you will find your reception tremendously improved by this new invention. There is no change necessary in your present set. This new, inexpensive improvement can be easily and quickly added. The results are positive, amazing and satisfying.

SEND NO MONEY

Send no money. We want to tell you in detail about this wonderful new invention and what it will do on your set. Just fill in and sign the coupon. It places you under absolutely no obligation. In sending you the information, we will include a Radio Log that gives important information about the principle broadcasting stations in the United States, Canada and Cuba.



Rathbun Mfg. Co., Inc.
Jamestown, N. Y.

Please tell me about the wonderful new radio invention that will so greatly improve radio control. Also send me your Radio Log.

Name.....

Street.....

City..... State.....

Better Shop Methods

Old Bill Talks on Cutting Fluids

(Continued from page 128)

soda improve the mixture and prevent the rusting of the machines and work. Water alone will perform the function of cooling, but it has the objection of causing rust on machine parts. The addition of soda overcomes this.

For grinding operations plain soda water is used a great deal, but it does not produce as good a finish as some of the specially compounded solutions for this work.

On punch-press work many kinds of lubricants are used. In some cases the metal to be worked is smeared with a pasty lubricant such as white lead and oil, tallow and graphite, or soft soap thinned with paraffin oil.

For metal drawing special drawing oils are used. They often are mixed with white lead or graphite. The lubricant sometimes is applied directly to the metal, but whenever practicable it should be applied to the ram, as there is always more or less accumulation of lubricant on the outside of the dies.

BORAX is claimed by some authorities to be superior to soda for mixing with compound cutting solutions. When using either of these the amount should be just sufficient to mix well with the water and oil. Too much soda or borax will cause the several ingredients to separate and necessitate frequent agitation of the liquid.

While borax water and soda water work well on grinding operations, for other kinds of metal working such as turning, milling, and drilling, the tools do not stand up as well as when oils or oil compounds are used.

A common fault of plain soda water or borax water is that it works under the slides and other working surfaces of the machines and cuts away the lubricating oils. This is another reason why oils generally are preferred. A watery solution also has to be changed more frequently than oil.

The question as to whether a cutting liquid is a lubricant or a coolant or both, the author leaves open for debate. On some work it appears to be only a lubricant, as with hand threading and metal drawing. On other work, like turning, milling, and drilling, its function takes more the form of cooling. As only a cutting edge is in contact with and actually buried in the metal, there would seem to be little chance for lubrication; the tool does not slide over the work with a film of oil between.

We associate lubrication with two or more sliding surfaces between which there is a film of oil and theoretically the two surfaces do not actually touch each other, but are kept apart by oil. This condition does not or cannot exist between a tool and the metal it is cutting and the term "cutting lubricant" seems incongruous. But, after all, the value is not in the name; it is in the thing. So I shall leave the reader to judge for himself whether a liquid cools or lubricates or does both.

"An Iron Indian Could Make Money With Your Ideas"

That is the opinion of D. H. Garrett (address on request) who followed my ideas and made \$630 in one week. Says his success is due to my methods and that the profits are far beyond those of any other small town business.

WHAT is the biggest money you ever made—\$100 a week—\$200 a week—\$500 a week?

D. H. Garrett was up against it financially. I helped him get started as a Real Estate Specialist. Now he writes me that he made over \$600 in a single week.

Another man I helped—a man who had been working in a shop at hard labor—writes me that he is just putting through his first real estate deal and making \$420 in one lump.

Another user of my system from Massachusetts, dropped in my office the other day and said he put through a deal the previous week that netted him \$1,500.

Isn't that the kind of a business you want to get into—a big-money business—where go-getters sometimes make as much in one deal as the average man earns in a whole year?

Write at once for my free book "How to Become a Real Estate Specialist." It tells how I started in my spare time—with less than \$5 capital—and earned more than \$100,000 net profit in less than five years.

It tells how other men and women—using my successful ideas—are making more money than they ever made before.

It tells how you can begin now—right at home—learn my successful system—become a Real Estate Specialist—build up an independent business of your own—make money my way.



What Others Say

"Your course fitted me for position as Sales Manager of largest contractors and builders' real estate department in our city."—*Henry J. Duillard, Michigan.*
 "Your system is wonderful. Without giving up my job as stationary engineer I made \$900 the first three months in my spare time."—*F. E. Stokes, Pennsylvania.*
 "Have been helped a great deal by your system. I have now a new car, two new typewriters, a stenographer and a dandy office and money in the bank, all through my own efforts and without any capital to start with."—*Mrs. P. Moore, Connecticut.*
 "One lesson has been worth \$3,500 to me."—*C. J. Lewis, Virginia.*
 "I have made a little over \$1,200 since beginning your course."—*S. M. Ford, Florida.*
 "Have sold one \$5,000 lot and three houses so far."—*Mrs. B. M. Morehouse, New York.*

Write for FREE BOOK at Once

Tear off the bottom margin of this page. Write on it your name and address. Drop it in the mail. You will then receive—without cost or obligation—a copy of my new, illustrated book which tells how you can do what others are doing—start in your spare time to learn my successful system and build up a money-making business of your own as a Real Estate Specialist. Get this important information now—at once—before it is too late. Find out how you can have a splendid business of your own and make more money than you ever thought possible.

American Business Builders, Inc., Dept. 34-C, 18 East 18th St., New York



Name.....

Address.....

American Business Builders, Inc., Dept. 34-C, 18 East 18th St., New York

Send along your free book "How to Become a Real Estate Specialist."



YOU CAN BUILD THIS IDEAL WORKBENCH—YOURSELF

THE pleasure of working with tools at home is greatly increased if you have a strong substantial bench with a good vise. One that also has drawers and tool cabinets is a constant incentive to keep tools in order and give them the care and attention they deserve.

A blueprint of the Home Workbench illustrated, with full size details and bill of materials, may be obtained by sending 25 cents to —

POPULAR SCIENCE MONTHLY
250 FOURTH AVENUE NEW YORK

Great NEW Invention

for seekers of

Health Power Beauty



Elco Health Generators at last are ready for you! If you want more health—greater power to enjoy the pleasures and delights about you, or if more beauty is your desire—write! Ask for the book on these inventions which has just been prepared. It will be sent to you without cost. It tells you how Elco Health Generators aid you in leaving the lethargy and hopelessness of bad health and weakness behind forever. Re-vitalize yourself. Bring back energy. Be wholly alive. Write today!

10 Days FREE Trial.
Write for FREE Book.



These great new inventions generate Violet Ray, Vibration, Electricity and Ozone—combined or separate.

They operate on the electric light in your home or on their own motive power at less than 50 cents per year. Elco Health Generators are positively the only instruments which can give you in one outfit Electricity, Violet Ray—Vibration and Ozone—the four greatest curative agents. Send the coupon below. Get the Free Book NOW!

Free Trial

For All These:

Rheumatism	Paralysis
Sore Throat	Pimples
Asthma	Falling Hair
Black Heads	Headache
Catarrh	Lumbago
Insomnia	Nervousness
Skin Diseases	
Hay Fever	
Neuralgia	
Deafness	
Pain	
Development	
Nervitis	
Obesity	



Mail Coupon for Free Book

Do not put this paper down without sending the coupon. Don't go on as you are with pains and with almost no life and energy. You owe it to yourself to be a better man or woman. You were put here to enjoy life—not just to drag through it. So do not rest another day until you have put your name on the coupon here. That will bring the whole story of these great new inventions. Do it today—now.

Health
Power
Beauty

Lindstrom & Company

30 West Lake St., Dept. 13-63 Chicago

Please send me your free book, "Health—Power—Beauty" and full information of your 10-day Free Trial Offer.

Name.....

Address.....

Better Shop Methods

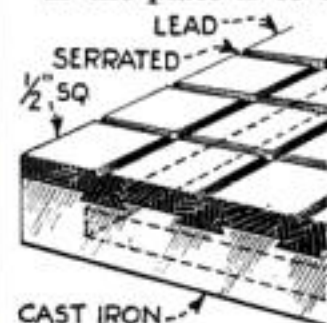
How to Make a Lapping Plate with a Surface of Lead

LAPPING plates with a leaden surface are preferred for certain kinds of tool work. A plate of this type may be made easily and will not cost much.

If the plate is to be cast specially for the purpose, the pattern should provide for four or more dovetail grooves across the upper surface, and the under surface be cored to reduce weight. If an old plate of any kind is available, dovetail grooves may be planed in it.

Make a box about 1 in. higher than the casting to go around its sides. Level the plate and pour the lead. When the surface is cool, plane it carefully in the shaper or planer. The surface then can be charged with diamond dust or flour emery.

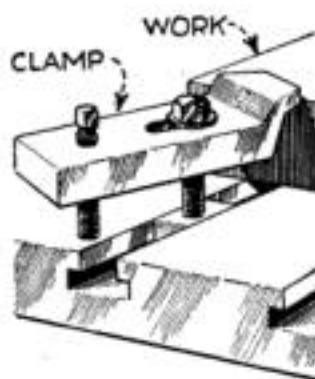
A serrated surface between the lands can be provided, if preferred.



One corner of the completed lapping plate

Time Saving Toolmaker's Strap

STRAPS or clamps made as shown will find many uses for clamping small tool work to faceplates and machine tables. An elongated slot is provided in each strap for the clamping bolt, and a setscrew at the back eliminates the use of blocking. A regular T-head bolt may be used or one having a T-slot nut. Straps of this design may be dimensioned to suit the requirements of the work to be done.



Ice Used in New Method of Bending Metal Tubes

IN THE shop as well as in chemical and physical laboratories it is sometimes necessary to bend small-caliber metal tubes without causing them to flatten at the bends. The common practice is to fill the tube before bending with molten resin, sulphur, paraffin or some metal alloy of low melting point. Such fillers prevent the flattening of the tube in bending, to a great extent, but often it is difficult to remove them afterward.

The U. S. Bureau of Standards recently developed a method which, while equally efficient in preventing the flattening of the tubes, has the additional advantage that the removal of the filler after bending offers no difficulty. The tube to be bent is filled with water and then immersed in a refrigerating solution. The water in the tube freezes and the ice filler prevents the flattening of the tube in bending. After the operation is completed the ice is melted and the water is blown out.—ERNEST WELLECK.



HERE is power so full and sturdy that it will drive a heavy row boat at launch speed!

Here is a motor so light, simple and "friendly" that a child can operate it. Here are instant starting and new control—you steer, stop or speed up from any seat in the boat. Here is the Super Outboard—The Super Elto.

12 Extraordinary Refinements

Including an added H. P. (4 full h. p., S. A. E. rating)—instant push-button reverse—silent underwater exhaust—finger-tip, quarter-turn starting—Propello pump—Safe rudder steering—and all at no increase in price!

Write for intensely interesting catalog!

ELTO OUTBOARD MOTOR CO.

Ole Evinrude, Pres.

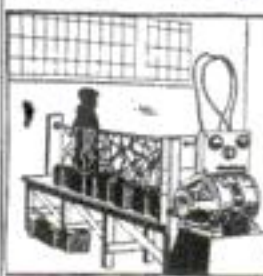
Dept. W Manfrs. Home Bldg.
Milwaukee, Wis.



Squab Book FREE

Printed in COLORS. Enlarged. Much News.

Squabs are raised in one month, they sell for high prices. Greatest market for 20 years. Make money breeding them. We ship everywhere on three months' trial our famous breeding stock. All pigeon supplies. Established 25 years. For prices and full particulars see our beautiful free book, "How to Make Money with Squabs," with pigeons in colors. Write for it today. PLYMOUTH ROCK SQUAB CO. 616 H St., Melrose Highlands, Mass.



HB ONE DAY BATTERY CHARGING

Over 12,000 shops making \$150 to \$300 monthly with One Day Charging. \$35 cash completely equips your shop for HB One Day Charging. Small monthly payments on balance. 30 days' free trial in your shop on money-back guarantee. Bulletin 126 free. Hobart Bros. Co., Troy, Ohio Box P3

ONLY \$16.50 MONTHLY—

\$1.50 FOR YOUR OLD RADIO TUBES

regardless make or condition, toward purchase of each new standard \$2.50 tube. Positively guaranteed. We do not sell re-built or bootleg tubes. Agents wanted. SUPER-SERVICE LABORATORIES, Dept. 20, Room 58, 39 West Adams, Chicago, Ill.



ZIP-ZIP

THOUSANDS of boys are made happy with this wonderful Zip-Zip shooter, something every boy wants and never gets tired of. Zip-Zip shooter is scientifically and practically made; boys, if you like hunting and outdoor sports, get a Zip-Zip shooter with plenty of pep and force and learn that quick and sure aim. If your dealer happens not to have them, order from us. Zip-Zip shooter complete \$5 or 3 for \$1.00; send stamps, coin or money order.



AUTOMATIC RUBBER CO., Dept. 22, COLUMBIA, S. C.

Inlays and Fancy Woods

We specialize in Fancy Cabinet Woods, Veneer Panels, Inlaid Borders and Plywoods of all kinds. Shipped anywhere. Write for Catalogue and Prices.

Fessenden Hall

218 S. 2nd St.

Philadelphia, Pa.

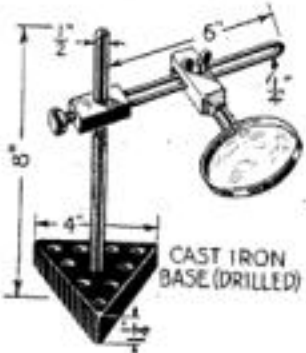
\$100 in Prizes

See Cash Prize Offer on Page 4 in front advertising section

Better Shop Methods

Adjustable Stand for Holding Shop Magnifying Glass

IN THE tool room a large magnifying glass has many uses and even for laying out ordinary work at the bench it is to be preferred to a smaller magnifier. The only drawback is the possibility that the expensive glass may be broken through careless handling. This difficulty can be met, however, by providing a stand for the glass as illustrated.

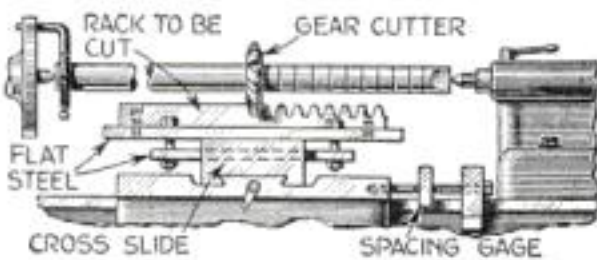


A large magnifier mounted for shop use

A stand of this type has stood for several years on one toolmaker's bench, and surprisingly many uses are found for the glass in the course of a day's work.—H. L.

How to Set Up a Lathe for Cutting Racks Accurately

WHEN a shop is not equipped with a milling machine suitable for cutting racks, it is possible to set up a lathe as illustrated for doing the work. The rack is screwed to a piece of flat steel,



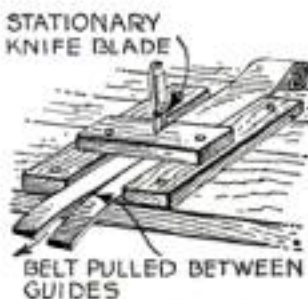
Work is mounted on cross slide and cutter is held on a long arbor between centers

which is packed up to the height that will make it possible to cut the teeth the proper depth. The cutter is held on a long arbor. Spacing is done by means of a gage the length of the pitch. The gage is used between a clamp on the bed of the lathe and a pin set in the end of the carriage. The cross feed is operated as on a milling machine.—CHARLES KUGLER.

A Novel Slitter for Belts

SLITTING a piece of belting into two or more pieces can be done quickly and accurately with the aid of the simple guide illustrated. All that is needed are three pieces of wood $\frac{3}{4}$ by 2 by 10 or 12 in., a dozen nails and a sharp pocket-knife.

Nail the pieces together and insert the knife into a slot in the upper one. Lay off and slit the belt by hand for about 6 in. from one end and place it in the guide. Pass the knife blade through the slit and tap it lightly into the bench about $\frac{1}{8}$ in. Then pull through the entire belt. If necessary, nail a piece of wood across the back end to hold the belt down in the guide.—EDWIN G. BAKER.



Cutting the leather

Look Sent on Approval

Adjusted to the Second; Adjusted to Temperature; Adjusted to Isochronism; Adjusted to Positions. 21 Ruby and Sapphire Jewels; 25 Year Gold Strata Case; Your choice of Dials; (Including Montgomery R. R. Dial); New Ideasing Thin Cases

The 21 Jewel Santa Fe Special

We will send this famous watch, express prepaid, for you to examine, to inspect, to admire, to approve without one penny advance payment. Examine the watch and be convinced it's the best watch buy you ever saw. Just a small payment down, the balance in easy MONTHLY payments. You use the watch while paying for it.

Save $\frac{1}{3}$ to $\frac{1}{2}$ of Your Money

By purchasing this Famous Santa Fe Special Watch. Not only are you saving money from the present day prices of watches, but you can still secure the "Santa Fe Special" Watch, at the same low prices and terms that have made our watches famous.

Ladies' Wrist Watches

Artistic, dependable ladies' wrist watches—perfect timepieces, beautiful hand engraved cases in white or green gold. Send for New Watch Book and see the new shapes and designs. Sent on approval and sold on payments.

Write for "Santa Fe" Watch Book

Clip the coupon, fill out and receive the FREE WATCH BOOK just off the press. All the newest watch case designs in white or green gold, fancy shapes and thin models are shown. Read our easy payment offer. Wear the watch 30 days FREE. Watch sent for your examination and approval without a penny down. Nothing to risk. See the watch before you buy.

Write for New Book Today and Select Your Watch. Mail Coupon

SANTA FE WATCH COMPANY

380 Thomas Building,
Topeka, Kansas
(Home of the Great Santa Fe Railway)

JUST OUT!

Send for our New Watch Book—Just off the press. It will post you about watch styles and values. Send for it today—it's FREE.

FREE BOOK COUPON
Santa Fe Watch Co.
380 Thomas Bldg.
Topeka, Kansas.
Please send prepaid and without obligation your New Watch Book Free, explaining your "No Money Down" Offer on the Santa Fe Special Watch.

Name.....

Address.....

State.....

RADIO—BARGAINS

FREE RADIO CATALOG & GUIDE of newest ideas, over 100 special hook-ups with illustrations. Shows savings up to 50% on standard radio parts, sets, kits. Be sure to get this thrifty book before you buy. Wonderful? Unusual? You'll say so. Write letter or postal NOW. BARAWIK CO., 102-122 S. Canal St., CHICAGO, U. S. A.

BURN YOUR NAME ON TOOLS

WITH THE ARKOGRAF

Protect Your Tools From Theft. Write with electricity any name or design on the hardest and finest tools and instruments, of any metal, like writing on paper with pen or pencil. Complete Outfit \$3.50 Prepaid Anywhere. Interesting illustrated circular free. Write today. Agents wanted. ARKOGRAF PEN CO., 1171-A East Stark St., Portland, Oregon



BUY DIRECT SAVE HALF

GRADE A QUALITY GOODS at WHOLESALE

Any handy man can install his own plumbing and heating by our new, easy method. Free installing plans show you how. You save waste and high labor cost with our cut-to-fit system. Fifty years of economy service to home owners, farmers, builders and mechanics. Million dollar plants behind our guarantee. FREE BOOK shows everything in plumbing and heating fixtures and supplies. Write today for copy. **HARDIN-LAVIN COMPANY** 106-16 West Pershing Road, Chicago, Ill. ESTABLISHED 1876

This New Illustrated, 1926, Limp Regal Leather ATLAS—Sent Free

The Great War changed the entire world—new governments, new boundaries and new civilizations were created... Everything learned in school must be "unlearned." This handsomely bound, concise book of trustworthy facts gives the correct data on the world as it is today.

**464 Pages—
Illustrated in Color**
10x15 inches
when open



You cannot read a newspaper intelligently, you cannot discuss a world question, a student is lost without this book for it contains the latest, authentic maps and history of every state in the U.S., every country—new and old—and of all principal cities on the globe.

107 new, authentic maps
—maps of every state and every country.

Concise history of the war.
New countries created.
New boundaries formed.

A vivid account of mankind's fight for civilization—story and pictures of prehistoric monsters.
The history, climate, races, characteristics and customs of people everywhere.

Government, education, religion and industries of every state and of every country.

It took a whole year and a host of editors, map engineers, writers and political economists to create this book—the best, most informative Atlas ever published. This Atlas fills a need—which no other book has ever done. It gives authentic facts and maps of the world as the world is today.

All Atlases published before this date are useless. They cannot be correct—they could not have followed the swift changes in world boundaries and world history.

If your name is in the telephone book in your city—this book will be sent you free. You can examine it for 5 days. If you feel that this new Atlas would be a bargain at three times the price asked, you can send \$2.98. This is the special introductory offer. This is the full payment. Send today—get this beautiful, limp, regal mission leather, handsomely illustrated 464-page Atlas of the world, as it is today.

Send No Money

DAVID B. CLARKSON CO., Publishers,
220 Clarkson Bldg., Chicago, Ill.

You may send me, all charges paid, your new Pictorial Atlas of the World, for five days' examination. I understand it is bound in flexible, regal, mission leather, illustrated in color and contains up-to-the-minute maps of each state and country; a complete census of the United States and historical facts and history of each country in the world and each state in the U. S.

If I am satisfied with the book, I will, at the end of five days, send you \$2.98—if not I will send it back to you and will be under no obligations whatever.

My telephone number is

NAME

ADDRESS

CITY.....STATE.....

\$100 in Cash Prizes

See Page 4 in
front of book
for details

WORK FOR "UNCLE SAM"

Railway Postal Clerks

\$1900 to \$2700 Year



MEN—BOYS 18 or Over
Steady work. No layoffs. Paid vacations.
Common education sufficient.

Travel—See Your Country
Mail Coupon today—SURE

FRANKLIN INSTITUTE, Dept. M-294, ROCHESTER, N. Y.
Sir: I want to travel on government pay. Please rush information telling how I can get a U. S. Government Job.

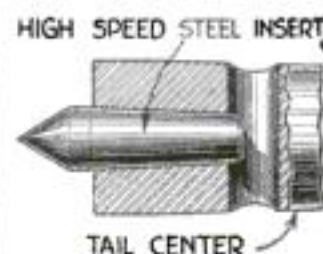
Name.....

Address.....

Better Shop Methods

High Speed Steel Inserts for Lathe Tail Centers

IN TURNING pieces of small diameter, especially if they are of alloyed steels, trouble oftentimes is experienced, where high speed is required to obtain a good finish, from the burning or galling of tail centers. An inexpensive method is illustrated that will overcome this trouble in most cases.



TAI CENTER
This center is not apt to burn or become galled

overcome this trouble in most cases.

A small high-speed steel center is inserted into a corresponding taper in the tail center, with a cross or drift hole to facilitate easy and quick replacement.

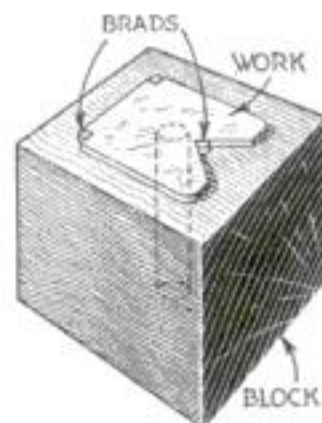
The high speed inserts should be hardened carefully, then drawn back at about 1050°F. They should be ground carefully to fit the tail center so that they will be interchangeable.

It will be found also that the high speed steel will stand more abuse from lack of lubrication and too much tension on the centers without picking up.—B. R. S.

Finishing Surfaces of Thin Machine Parts

THIN work often cannot be clamped hard enough in a vise to hold it for finishing its surfaces without bending or springing it. In such cases good results may be obtained by clamping a wooden block in the vise and mounting the work upon it with several wire brads, as shown.

The heads of the nails are filed off flush with the surface of the work to allow the part to be removed and replaced easily. The hole in the block is for the reception of a rod to eject the work if it can not be removed readily with the fingers.



The work is held on a wooden block by brads

While this method is adapted particularly for filing and polishing surfaces, it may be employed for light machining, such as drilling or milling small slots. In the latter case, however, clamps of some sort are required.

For this purpose several screws with large heads overlapping the work will serve. A portion of the screw heads may be filed off for convenience in placing and removing the work.—S. W. BROWN.

THE practice of resharpening files is seldom, if ever, economical. Some of the larger may be recut by factories making a specialty of such work, but resharpened or recut files do not give as satisfactory service as new files.

LUMINOUS PAINT

Make Your Watches, Clocks, Etc., Visible by Night

The very latest discovery in the scientific world. Hitherto, practically unobtainable except at an exorbitant price, we have at last succeeded in producing this remarkable LUMINOUS PAINT, which, applied to the surface of any article, emits rays of white light, rendering it perfectly visible in the dark. THE DARKER THE NIGHT, THE MORE BRILLIANT IT SHINES. Quite simple to use. Anyone—you can do it. A little applied to the dial of your watch or clock will enable you to tell the time by night. You can coat the push buttons or switch plates of your electric lights, match boxes, and innumerable other articles; make your own Luminous Crucifixes, Luminous Rosaries, etc. Bottle containing sufficient to coat several small articles. Price 25c. Larger sizes 50c and \$1 postpaid. Johnson Smith & Co., Dept. 502, Racine, Wis.

Microphone Transmitter Button



You can easily make a highly sensitive detectaphone by using this Transmitter Button to collect the sound waves. You can build your own outfit without buying expensive equipment. It is simple and inexpensive. You can install an outfit in your home and hear conversations being held all over the house. You can connect up different rooms of a hotel. This outfit was used by secret service operatives during the war. It is being used on the stage. It is also sensitive and is the greatest invention in microphones. You can mount the button almost anywhere—on a door, stove, paper, stuff calendar, on the wall behind a picture frame, etc. Button is so light and small it cannot be detected. Persons can be overheard without suspecting it. You can listen in on conversations in another room. A deaf person in the audience can hear the speaker. Connected to phonograph, piano or other musical instrument, music can be heard hundreds of feet away. Button may be used to renew telephone transmission; often makes an old line "talk-up" when nothing else will. The ideal microphone for radio use; carries heavy current and is extremely sensitive. Amplifies radio signals. Countless other similar uses will suggest themselves. Experimenters find the Button useful for hundreds of experiments along the lines of telephones, amplifiers, loud speakers, etc. Many fascinating stunts may be devised, such as holding the button against the throat or chest to reproduce speech without sound waves. \$5.00 is given to anyone who sends in a new suggestion for the use of the Button providing the manufacturers find it suitable for use in their literature. PRICE \$1.00 POSTPAID ANYWHERE.

U.S. BABY TANK

It goes with real Yankee Pep—by its own power. Most remarkable Toy ever invented. By drawing the Tank backward, either with the hand or over the floor or table and then placing it down it will crawl along, overcoming all obstacles, in the same life-like manner as the larger Tank that proved so deadly in the great war. What makes it go is somewhat of a mystery, for there is no mechanism to wind up as is usually understood with mechanical toys. It will perform dozens of the most wonderful stunts it will go backward or forward at will. 2 1/2 inches long. Price only 25 cents prepaid.

ANARCHIST BOMBS

One of these glass vials dropped in a room full of people will cause more consternation than a limburger cheese. The smell entirely disappears in a short time. 10c a Box, 3 Boxes for 25c.

INVISIBLE INK

The most confidential messages can be written with this ink, for the writing MAKES NO MARK. Cannot be seen unless you know the secret. Invaluable for many reasons. Keep your postals and other private memoranda away from prying eyes. Great fun for playing practical jokes. Only 15c Bottle.

MIDGET BIBLE

Greatest Curiosity. Smallest Bible in the world. Size of a postage stamp. 200 Pages. Said to bring good luck to the owner. A genuine work of art. Must be seen to be appreciated. Make good money selling them to friends, church acquaintances, etc. PRICE 15c each, 3 for 40c, 12 for \$1.35, 100 for \$7.50. Also obtainable in Leather Binding, with gold edges. Price 50c each, 3 for \$1.25, \$4.50 per doz. Magnifying Glass for use with Midget Bible, 15c.

Every Boy His Own Toy Maker

Greatest boys' book written. Tells how to make a Pinhole Camera, a Cannon, model Railroad, a Telephone, Boomerang, Telegraph Instrument, Box Kite, Talking Machine, Microscope, Electric Motor, Electric Door Bell, Water Wheel, Paddle Raft, a pair of Skis, a Dog Sled, Bird House, Rabbit Yard, etc. 64 pages, 150 illustrations. PRICE, 10c postpaid; 3 for 25c.

Surprise Matches

More fun than fighting with your wife. Look just like ordinary matches. Put 10c in boxes just like regular Safety Matches. As the victim tries to light one he gets quite a surprise. Price 10c per box, 3 boxes for 25c postpaid, 12 for 75 cents.

MAGICIAN'S OUTFIT

Apparatus and Directions for a Number of Mysterious Tricks Enough for an Entire Evening's Entertainment. ANYONE CAN DO THEM. 75c.

It is great fun mystifying your friends. Get this Conjurer's Cabinet, and you will be the cleverest fellow in your district. It contains the apparatus for seven marvelous tricks, including The Disappearing Glass, that, when placed on the head of your coat, vanishes from sight as will the Magic Yarn and Jack Trick or Wooden Ball is placed inside, and upon replacing the lid has disappeared and is found in someone else's pocket; The Magic Nail which you can apparently cut your finger almost in two; The Wonderful Card Trick in which an entirely different card is found; The Disappearing Coin Box a coin is placed in the little wooden barrel, and, when opened again, is found to have vanished entirely, or can be made to change into a coin of another denomination; The Famous Disappearing Penny Trick; The Glass Goblet and Vanishing Coin Trick a coin is dropped into a glass of water, and when the water is poured out the coin has vanished. With the tricks described above, we send full printed instructions for performing each trick, so that anyone can readily perform all the tricks to the great amusement of their friends or the public. Any boy of ordinary intelligence, with this Cabinet of Tricks in his possession, can give a perfect entertainment not inferior to some regular magicians. Besides the tricks contained in the Cabinet, there are many other facts and illusions fully explained with full printed instructions, for which you easily make or procure the necessary apparatus. This unexcelled Cabinet of Tricks for ONLY 75 CENTS POSTPAID TO ANY ADDRESS.

A Deluxe Edition of our new 1925 CATALOG mailed on receipt of 25c. Handsome cloth binding. Only book of its kind. 400 pages of all the latest tricks in magic, the newest novelties, puzzles, games, sporting goods, interesting books, experiments in seeds and plants, etc., unapproachable elsewhere.

STAGE MONEY

With a bunch of these bills, it is easy for each person of limited means to appear prosperous by flashing a roll of these bills at the proper time and peeling off a genuine bill or two from the outside of the roll, the effect created will be found to be all that can be desired. Prices, postpaid: 40 Bills 20c, 125 for 50c, or \$3.50 thousand postpaid.

Wonderful X-Ray Tube

A wonderful little instrument producing optical illusions both surprising and startling. With it you can see what is apparently the bones of your finger, the lead in a lead pencil, the interior of a pipe stem, and many other similar illusions. A mystery that no one has been able to satisfactorily explain. Price 10c, 3 for 25c, 1 dozen 75c. Johnson Smith & Co.

Good Luck Ring

Quaint and Novel Design. A VERY striking and uncommon ring. Silver finish, skull and crossbones design, with two brilliant, flashing gems sparkling out of the eyes. Said by many to bring Good Luck to the wearer, hence, the name Good Luck Ring. Very unique ring that you will take a pride in wearing. ONLY 25 CENTS.

Exploding Cigarettes

JUST LIKE ORDINARY CIGARETTES. BUT SUCH REAL STARTLERS! The box contains ten genuine cigarettes of excellent quality. They appear so real, but when each cigarette is about one-third smoked, the victim gets a very great surprise as it goes off with a loud BANG! A great mirth provoker yet entirely harmless. Price 25c per box.

Popular Watch Charms

ONLY 15c. 3 for 40c; \$1.35 doz.

CIGARETTE MAKER

Roll your own and save money. Makes them better and quicker besides saving more than half. Use your favorite brand of tobacco. Neat, useful and handy. Pocket size, weighs 1/4 oz. Made entirely of metal, nickel-plated. Price 25c postpaid.

MAGIC FLUTE

Wonderfully Sweet Toned and Musical. The Magic Flute, or Humanator, is a unique and novel musical instrument that is played with nose and mouth combined. There is just a little knack in playing it which, when once acquired after a little practice will enable you to produce very sweet music that somewhat resembles a flute. There is no fingering, and once you have mastered it you can play all kinds of music with facility and ease. When played as an accompaniment to a piano or any other musical instrument the effect is as charming as it is surprising.

Kissing Permit

A handsome metal badge, nickel plated, that you can wear, giving you fun out of all proportion to its trifling cost. PRICE 10c each, 3 for 25c, or 12 for 75c postpaid.

Japanese Rose Bushes

The Wonder of the World. Japanese Rose Bushes bloom all the year round. Just think of it. Six weeks after planting the seed, the plants will be in full bloom. It may not seem possible, but we positively guarantee it to be so. They will bloom every ten weeks, Summer or Winter, and when three years old the bush will be a mass of roses, bearing from five hundred to a thousand roses on each bush. The flowers are in three shades—white, pink, and crimson. The plants will do well both in and out doors. We guarantee at least three bushes to grow from each packet of seed. Price, 10c packet, 3 pkts. for 25c postpaid.

Japanese Rose Bushes

The Wonder of the World. Japanese Rose Bushes bloom all the year round. Just think of it. Six weeks after planting the seed, the plants will be in full bloom. It may not seem possible, but we positively guarantee it to be so. They will bloom every ten weeks, Summer or Winter, and when three years old the bush will be a mass of roses, bearing from five hundred to a thousand roses on each bush. The flowers are in three shades—white, pink, and crimson. The plants will do well both in and out doors. We guarantee at least three bushes to grow from each packet of seed. Price, 10c packet, 3 pkts. for 25c postpaid.

BLANK CARTRIDGE PISTOL

Price \$1.00 Postpaid. This well made and effective Pistol is modeled on the pattern of the latest type of Revolver, the appearance of which alone is enough to scare a burglar, whilst, when loaded, it will probably prove just as effective as a revolver with real bullets, without the danger to life. It takes the standard .22 Calibre Blank Cartridges, that are obtainable most everywhere. Even the most timid women can use it with perfect safety and frighten a thief without risk to herself or anyone else. A Great Protection Against Burglars, Tramps and Dogs. You can have it lying about without the danger attached to other revolvers. We sell large numbers around the 4th of July. Well made of solid Metal. PRICE ONLY \$1.00 Postpaid. Blank Cartridges .22-cal. shipped by express only, 50c per 100. Johnson Smith & Co., Dept. 502, Racine, Wis.

Sneezing Powder

Place a very small amount of this powder on the back of your hand and blow it into the air, and everyone in the room or car will begin to sneeze without knowing the reason why. It is most amusing to hear their remarks, as they never suspect the real source, but think they have caught it one from the other. Between the laughing and sneezing you yourself will be having the time of your life. For parties, political meetings, car rides, or any place at all where there is a gathering of people, it is the greatest joke out. Price 10c or 3 for 25c.

Mystic Skeleton

10c & pd. A jointed figure of a skeleton 14 in. in height, will dance to music and perform various gyrations and movements while the operator may be some distance from it.

Serpent's Eggs

Box contains 12 eggs. When lit with a match, each one gradually hatches itself into a snake several feet long, which curls and twists about in a most life-like manner. Price per box 10c postpaid.

BOYS! BOYS! BOYS! THROW YOUR VOICE

Into a trunk, under the bed or anywhere. Lots of fun fooling the teacher, policeman or friends. THE VENTRILO a little instrument, fits in the mouth out of sight, used with above for Bird Calls, etc. Anyone can use it. Never Fails. A 32-page book on ventriloquism, and the Ventrilo, ALL FOR 10c postpaid.

ITCHING POWDER

This is another good practical joke; the intense discomfort of your victims to everyone but themselves is thoroughly enjoyable. All that is necessary to start the ball rolling is to deposit a little of the powder on a person's hand and the powder can be relied upon to do the rest. The result is a vigorous scratch, then some more scratch, and still some more.

Great Fire Eater

Most Sensational Trick of the Day! With the Fire Eater in his possession any person can become a perfect salamander, apparently breathing fire and ejecting thousands of brilliant sparks from his mouth, to the horror and consternation of all beholders. Harmless fun for all times, seasons and places. If you wish to produce a decided sensation in your neighborhood don't fail to procure one. We send the Fire Eater with all the materials, in a handsome box, the cover of which is highly ornamented with illustrations in various colors. Price of all complete only 30 cents, postpaid.

LOOK 35c Look

Wonderful Instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngoscope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. Price, only 35c or 3 for \$1.00 postpaid.

SQUIRT ROSE

25c. A REAL STARTLER. This is the most popular of all squirt tricks. The flower in your coat looks so fresh and sweet that everyone is tempted to inhale the delightful perfume. Then is the moment to press the bulb. Guaranteed! Don't they jump? There is a very long rubber tube that easily reaches to the pocket of your coat or trousers, and the bulb is large enough to make a dozen shots with one loading. PRICE 25c each, or 3 for 65c postpaid.

LOOK 35c Look

Wonderful Instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngoscope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. Price, only 35c or 3 for \$1.00 postpaid.

LOOK 35c Look

Wonderful Instrument. Greatest thing yet. Nine separate articles in one. Everybody delighted with it. Odd, curious and interesting. Lots of pleasure as well as very useful. It is a double Microscope for examining the wonders of nature. It is also an Opera Glass, a Stereoscope, a Burning Lens, a Reading Glass, a Telescope, a Compass, a Pocket Mirror, and a Laryngoscope—for examining eye, ear, nose and throat. It is worth all the cost to locate even one painful cinder in the eye. Folds flat and fits the pocket. Something great—you need one. Don't miss it. Sent by mail, postpaid. Price, only 35c or 3 for \$1.00 postpaid.

JAPANESE ROSE BUSHES

The Wonder of the World. Japanese Rose Bushes bloom all the year round. Just think of it. Six weeks after planting the seed, the plants will be in full bloom. It may not seem possible, but we positively guarantee it to be so. They will bloom every ten weeks, Summer or Winter, and when three years old the bush will be a mass of roses, bearing from five hundred to a thousand roses on each bush. The flowers are in three shades—white, pink, and crimson. The plants will do well both in and out doors. We guarantee at least three bushes to grow from each packet of seed. Price, 10c packet, 3 pkts. for 25c postpaid.

Postage Stamps Accepted

ADDRESS ORDERS FOR ALL GOODS ON THIS PAGE TO

JOHNSON SMITH & CO. DEPT. 502, RACINE, WIS.

Money Making Opportunities for "Popular Science" Readers



Readers of POPULAR SCIENCE MONTHLY will find scores of opportunities in this section (pages 128F to 158) for making more money.



ELECTRICITY

as Taught in COYNE Shops

**Puts You In the
Big-Pay Class
Quickly!**

HUNDREDS OF
COYNE-TRAINED
MEN EARN
\$60 to \$200
A WEEK!



Student Winding Stator at COYNE

COMPLETE ELECTRICAL TRAINING

In 12 Happy Weeks at COYNE

My newly enlarged Electrical Course is the result of 27 years of experience, solving the needs of young men and of the Electrical Field. COYNE has been teaching Electricity in a PRACTICAL way since 1899. My course is thorough, easy to master, and fits men for BIG Electrical jobs, the HIGH-SALARIED thrilling jobs.



H. C. LEWIS
President, Coyne
Electrical School

We Teach Electricity and Nothing Else

COYNE teaches only ONE thing—ELECTRICITY. We are SPECIALISTS. Our interests are not divided, nor is Electricity a sideline or merely an "additional" subject with us.

You Can Start Any Day of the Year at COYNE—No Classes or Seasons. Get the Coupon Mailed Right Away so that You May Read Full Particulars of My Course. My Big FREE Book will Amaze You!

RAILROAD FARE TO CHICAGO

included without extra cost if you act AT ONCE. Get full particulars before this amazing offer is withdrawn.



Students
Constructing Outdoor
Substation at COYNE

Earn While You Learn at COYNE.

My Employment
Department will
help you.

Students producing "artificial lightning" on Tesla coil in great shops of Coyne

Students operating large switch-board at Coyne



You Don't Need Advanced Education or Experience to Learn at COYNE

Don't worry if you lack advanced education, knowledge of higher mathematics, or experience. My course is a practical, LEARN-BY-DOING Course. Every COYNE student receives INDIVIDUAL and PERSONAL instruction, on COMPLETE electrical apparatus, under EXPERT INSTRUCTORS, in the COYNE Shops at Chicago.

Send for Big FREE Book!

I want to send you a copy of my big, attractive Electrical Book. It is 12x15 in size and contains 151 photos of electrical scenes. Tells about dynamos, radios, autos, airplanes, farm lighting and power, etc. Absolutely FREE. Remember.

SEND COUPON NOW

H. C. LEWIS, President
COYNE ELECTRICAL SCHOOL
1300-10 W. Harrison St.
Dept. 1363, Chicago, Illinois

Dear H. C.—You can just bet I want one of those big, handsome FREE 12 x 15 books, with 151 actual photographs printed in two colors. Send it quick. Be sure to tell me all about R. R. Fare Offer and Special Courses without extra cost.

Name.....
Address.....

Be sure to write at once so that you will get
RAILROAD FARE TO CHICAGO
included without a penny extra cost

Tune in on COYNE Radio Station WGES

COYNE ELECTRICAL SCHOOL

H. C. LEWIS, President Established 1899

1300-10 W. Harrison St. Dept. 1363 Chicago

There is no Substitute for Personal Training, in
Great Shops, on COMPLETE Apparatus

Letters that Won Prizes in the January Contest

The practical value of correspondence schools is effectively pictured in the following letter regarding the American School of Aviation. This letter wins the First Prize of \$50 for John F. Hardecker of Brooklawn, N. J.

Contest Editor:

As Assistant Chief Draftsman of the Naval Aircraft Factory I frequently have inquiries from men who want to get into Aviation. You can readily appreciate that the man utterly unfamiliar with Aviation, no matter how skilled otherwise, is of little monetary value to the industry or himself in it. To refer him to the average textbook, written purely from a highly technical viewpoint, is most unsatisfactory.

The ad of the "American School of Aviation" therefore especially appealed to me. Here was an opportunity for the prospective aviation man to gain the required knowledge while continuing at his present job. So I referred several recent applicants to them, having also recently had the good fortune to interview one of their students who showed me convincingly that he is getting just what he actually needs to enter this field, fully equipped for a responsible and well paying position.

Yours truly,

JOHN F. HARDECKER.

The Second Prize of \$25 is awarded to William Gray of Youngstown, Ohio, for his letter telling how the International Correspondence Schools have helped him.

Dear Editor:

To me, the most interesting advertisement in the Money Making Opportunity Department of POPULAR SCIENCE MONTHLY is that of the International Correspondence Schools.

Twelve years ago, after finishing my apprenticeship in Scotland as a stone-cutter, I came to this country. For two years I worked at my trade throughout the United States. Then I subscribed to the I. C. S. for its courses in English, Stenography and Typing. For three months I studied, day and night, completing the courses with a percentage of 95. On the strength of this I got a start as a newspaper reporter on the Cincinnati Commercial Tribune. Five years later I became its city editor. Today I am news editor of the Youngstown Telegram, in full charge of all the news printed in the five editions published daily.

Thanks to the I. C. S. I am earning twice as much as I could cutting stone.

Respectfully yours,

WILLIAM GRAY.

(Continued on page 128G)

Letters that Won Prizes in the January Contest

(Continued from page 128F)

For her letter about the Crown Fuel Saver Company and how they opened the door of opportunity for her father, Miss Grace M. Baker of Washington, D. C., wins the Third Prize.

Contest Editor:

My 1925 subscription to "POPULAR SCIENCE" was a Christmas Gift from my father, which in reality was a wonderful gift to himself.

One of the most promising Opportunities Ads that my father answered was that of the Crown Fuel Saver Co., of Richmond, Indiana. Being granted this territory for the sale of Crown Fuel Savers, he at once developed a remarkable business.

Father accepted your guarantee of Advertisers in "POPULAR SCIENCE MONTHLY" at 100%. He found this Company composed of Real Red-Blooded Christian Men, who help a man to succeed if he has the willingness, pluck and perseverance.

Also, having bought various articles under your (I. S.) Guarantee, I find "POPULAR SCIENCE MONTHLY" indispensable from every standpoint. To Crown it all, "Money Making Opportunities" is a "Wireless Message" where all who read can tune in and win.

Sincerely yours,
GRACE M. BAKER.

The money to be made as a finger print expert is illustrated in the following letter from G. Rose of the Police Department of Huntington, West Virginia, who tells how he found his road to success through the advertising of the University of Applied Science.

Contest Editor:

You look at it, I looked at it, tell everybody to look at it, it is on page No. 165.

It put My Wife, My Self and Seven Kiddies in a Home Of Our Own, it put Me in this Office, a good steady position at a very satisfactory salary; write Mr. Lawrence Sands of the First National Bank, Pittsburgh, Pa. It put the parties in the Penitentiary that attempted to rob his Bank, and in return put Me the proud possessor of that *Ten Thousand Dollar Reward* offered by his Bank, and it put Me in a position to do this without leaving this office. It, Dear Editor, is the interesting Ad of the University of Applied Science, 1920 Sunnyside Avenue, Chicago, Ill. Finger Prints; they are everywhere, more of them than anything else.

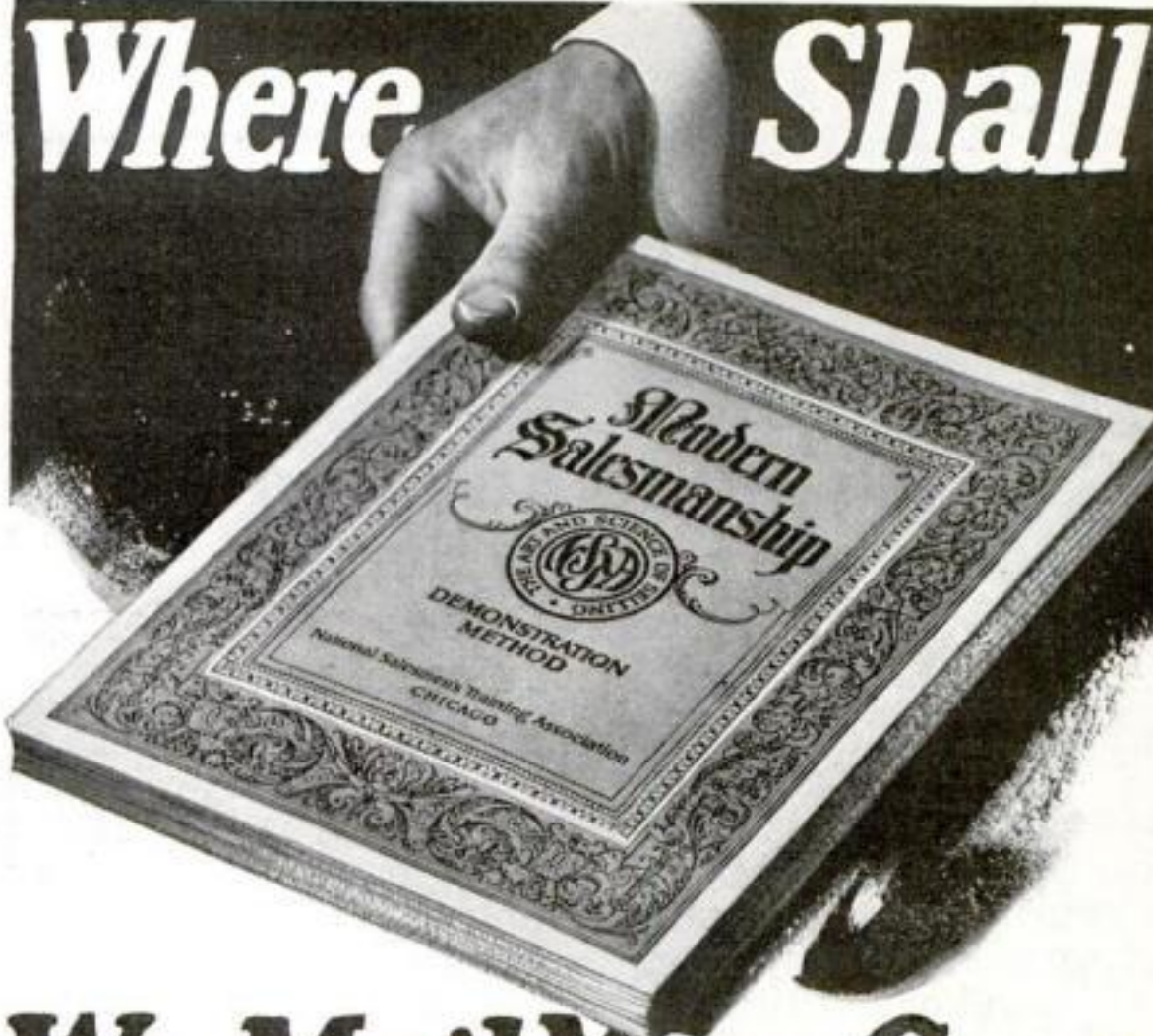
Sincerely,
G. ROSE.

Charles L. Nelson of Academy, South Dakota, devotes most of his letter to the advantages to be found in the Money Making Opportunities Section. But in one paragraph he concentrates on the wonderful success brought to him from a law course he took from the La Salle Extension University.

Contest Editor:

The most valuable advertisement in your January issue is your own, pages 120, 150.

(Continued on page 128H)



We Mail Your Copy of This Book-FREE

Remarkable new book on Salesmanship just off the press will be mailed to you without cost or obligation

THE contents of this amazing new book—just published by the National Salesmen's Training Association—will prove a revelation to every man who is interested in making real money—and to those who realize the tremendous possibilities for high earnings in the selling field.

Thirty thousand copies of this book will be mailed free without cost or obligation to those who send for it while the supply lasts.

FULLY EXPLAINS NATIONAL DEMONSTRATION METHOD

Thousands have wondered why N. S. T. A. Members invariably make good, in a big way, right from the start, even though they have had no former selling experience, or why salesmen who have just plodded along with indifferent success quickly begin to outstrip their brother salesmen after becoming members of the Association.

Among other things, this remarkable free book explains just why success comes rapidly and surely to those who enroll for this amazing System of Salesmanship Training.

QUICK SUCCESS THROUGH N. S. T. A. TRAINING

Whether you have had selling experience or not, it makes no difference. The N. S. T. A. System of Salesmanship Training will enable you to become a Master Salesman in an amazingly short period of time. It will teach you, in your spare time, at home, the fundamental rules and principles of selling—how to approach different types of prospects to get their undivided attention—certain ways to stimulate keen interest—ways to overcome objections, batter down prejudices, outwit competition, and make the prospect act.

Step by step this Training takes you through every phase of Salesmanship. Every underlying principle of the sales strategy is made as simple as A B C. Through the National Demonstration Method, you get actual experience on practically every type of sales problem that may ever present itself. And through the instruction in Character Analysis you will become an expert in reading character on sight—a valuable asset for any salesman.

TYPICAL EXAMPLES OF SUCCESS

When A. H. Ward, Chicago, returned from the war he was making \$20 a week. He enrolled with the N. S. T. A. and last year earned \$13,500 and was elected an officer of Post's, Chicago. J. H. Cash, Atlanta, Ga., jumped from \$25 a week to \$500 a month. M. V. Stephens, of Albany, Ky., earned \$25 a week when he enrolled. His last report showed he was earning \$125 a week. O. H. Malfroot, Boston, Mass., stepped into a \$10,000 position as Sales Manager—so thorough is this training.

You will find hundreds of similar success stories in our Literature—successes you can easily duplicate.

BIG DEMAND FOR TRAINED SALESMEN

City and traveling sales positions are open in every line all over the North American continent. For years thousands of leading wholesalers, jobbers, and manufacturers have called on the Association to supply them with salesmen. Employment service is free to both employers and members, and thousands have secured positions through this service. Surely this is a glowing tribute to the thoroughness and practicability of our System of Salesmanship Training and Employment Service.

JUST MAIL THE COUPON THE BOOK IS FREE

To fill in and mail the coupon will not obligate you in any way, but it will show you the way to be a "star" salesman. It will pay you to let us send you this valuable and interesting book. Fill in and mail the coupon and get it into the mail sometime today.

**NATIONAL SALESMEN'S
TRAINING ASSOCIATION**
WORLD'S OLDEST AND LARGEST SALES TRAINING INSTITUTION
Dept. C-15, N. S. T. A. Bldg., Chicago, Illinois

National Salesmen's Training Ass'n,
Dept. C-15, N. S. T. A. Bldg., Chicago, Ill.
Without cost or obligation you may send me your free book, "Modern Salesmanship," and details of your System of Training and Free Employment Service.
Name.....
Address.....
City..... State.....
Age..... Occupation.....

Building Draftsmen WANTED



\$9,000 in Four Months
"I have made \$9000 in 4 months on nine buildings" writes Wm. J. Petrasek, Chicago, Ill.

\$210 Per Month
"I am making \$210 per month as Architectural Draftsman. Thanks to Chicago Tech." Geo. E. Shaffer, Haley, Tenn.

\$6,000,000,000 in Building

Train at Home for Big Money in This Fertile Field

Six Billion Dollars in one year! Think of it! Today Building is probably America's greatest and most profitable industry. Here is a field

whose future is insured by the normal growth in population and the industrial expansion of our country. There is a big building shortage now and many competent observers predict that our largest cities will be practically rebuilt in the next ten years due to ever higher standards of living. Six Billion Dollars spent each year in building means fortunes for thousands who have the vision to grasp the opportunity open now to get in on the ground floor.

Get Into Big Pay This Easy Way

Architectural or Building Draftsmen are needed everywhere. Get out of the low or moderate pay job. Step into a *real* job. You can do it with training in Architectural Drafting. Salaries are big because of the tremendous demand and the shortage of trained Building Draftsmen. Work is steady and you have a splendid chance to go into business for yourself. This

is the opportunity offered to you by this old established school of Architecture and Building Construction. Step out of the \$40 a week class. Learn how to earn \$50 to \$100 a week—and later \$5,000 to \$10,000 a year as chief or superintendent.

Train at Home—Earn as You Learn

No need to quit your present job. Keep your present income and prepare for a bigger one. Our simple "Practice Plan Method" will qualify you quickly in your spare time. Into it has gone over 25 years of experience and the best knowledge of our large staff of architects and builders. It is simple, complete, resultful. Practical, successful builders guide you. Lessons in plain English. A common schooling is all you need. Get the facts now—today.

FREE TRIAL LESSON AND BLUE PRINTS

Just to show you how easy it is to learn Architectural Drafting by our method, we will send you a Trial Lesson and Blue Prints Free. Test yourself and see how you like the work. Send no money—just the coupon. Get this Free Lesson now with our Big Book of Opportunity also free. Make your first step today—it costs you nothing.

MAIL COUPON TODAY

Chicago Tech. College, Dept. 331 Chicago Tech. Bldg., 118 East 26th St., Chicago, Ill.
Send me, without obligation, your Free Trial Lesson, Blue Prints and Book of Opportunity. I want to know how to become a Building Draftsman. It is understood that no salesman will call on me.

NAME.....
ADDRESS.....
CITY OR TOWN.....STATE.....

This \$25.00 Drawing Outfit

Sent without extra cost. Good for a lifetime. Mail the coupon and learn how to secure this valuable outfit.



CHICAGO TECHNICAL COLLEGE

Dept. 331 Chicago Technical Bldg.
118 E. 26th St. Chicago, Ill.

Letters that Won Prizes in the January Contest

(Continued from page 128G)

This because it promotes a wider reading of the advertisements, the greatest opportunity of today, voices the purpose and multiplies enormously the value of this magazine in promoting ambition, progress, achievement and opportunity.

The advertisements hold a key to opportunity, information, knowledge that leads to more knowledge, power, money, a life career—opportunity unparalleled—unequaled in any age.

A dozen men nationally known, a score of leading business executives, another score, incomes in five figures and over half as many more with private businesses worth upwards of a million dollars each, hundreds, thousands of lesser achievement, owe their successes in great measure to the reading of an advertisement.

To me it gave a law course (La Salle,) two farms, information, knowledge, a business, business training worth thousands of dollars, independence for life.

CHAS. L. NELSON.

These letters illustrate graphically the success that can be yours if you take advantage of the offers advertised in the Money Making Opportunities Section.

Start on the road to success to-day. Study all the advertisements shown on pages 128F to 158. Select those that offer you the opportunity you are most interested in and fill in the coupons or write for further information.

Complete List of PRIZE WINNERS

In the January Contest

FIRST PRIZE \$50

John F. Hardecker, Brooklawn, N. J.
(American School of Aviation)

SECOND PRIZE \$25

William Gray, Youngstown, Ohio
(International Correspondence Schools)

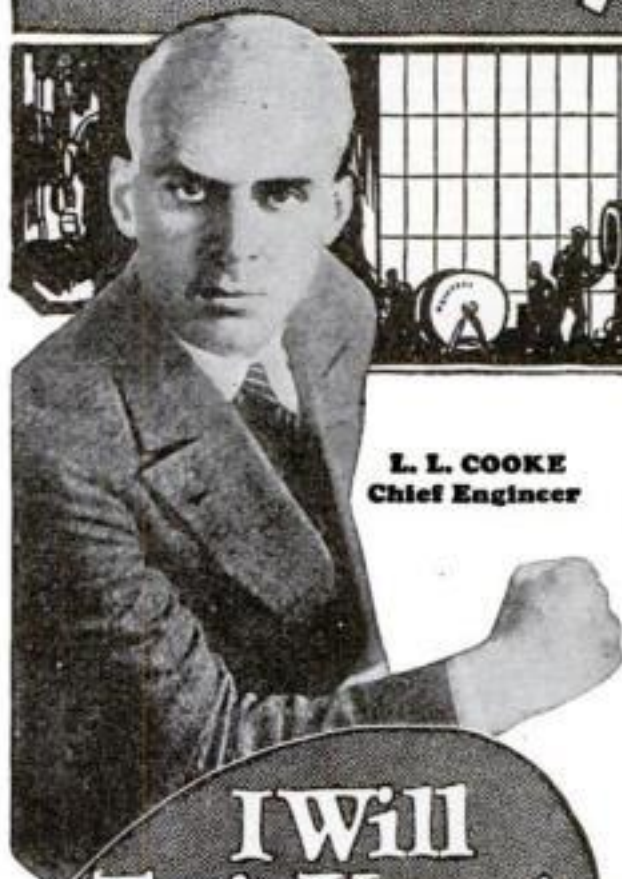
THIRD PRIZE, \$10

Grace M. Baker, Washington, D. C.
(Crown Fuel Saver Co.)

PRIZE WINNERS who receive \$1.00 each for their letters

G. Rose, Huntington, West Va.
(University of Applied Science)
Chas. L. Nelson, Academy, S. D.
(La Salle Extension University)
Eric C. Webb, Denver, Colo.
(Mac-O-Chee Mills)
D. J. Deming, Lynn Haven, Fla.
(University of Applied Science)
O. F. Sternemann, Paauilo, Hawaii
(University of Chicago)
Scudder Martin, San Luis Obispo, Cal.
(David B. Clarkson Co.)
Rev. L. V. Bennett, Cook, Minn.
(Washington School of Cartooning)
Edward O'Brien, Williamsport, Pa.
(International Correspondence Schools)
L. B. Pearson, Coalwood, W. Va.
(American School of Aviation)
M. D. Martin, Oglesby, Texas
(National Radio Institute)
Rev. Alan Pressley Wilson, Baltimore, Md.
(U. S. School of Music)
Leslie J. Miller, Rock Springs, Wyo.
(Northwestern School of Taxidermy)
Lloyd H. Bell, Washington, Penna.
(Producers League)
Margaret Haines, Fayette City, Pa.
(Sherwin Cody School of English)
Leonard L. Siscoe, Laingsburg, Mich.

Electrical Experts are in Big Demand!



L. L. COOKE
Chief Engineer

**I Will
Train You at
Home for a
Big Pay Job**
L.L.C.

**5 Big Fine
Outfits
to work with
No Extra Charge**



With me, you do practical work—at home. You start right in after your first few lessons to work at your profession in the regular way and make extra money in your spare time. For this you need tools, and I give them to you—5 big complete working outfits, with tools, measuring instruments, and a real electric motor—5 outfits in all.

It's a shame for you to earn \$15 or \$20 or \$30 a week, when in the same six days thousands of men as Electrical Experts are making \$70 to \$200—and do it easier—not work half so hard. Why then remain in the small-pay game, in a line of work that offers no chance, no big promotion, no big income? Fit yourself for a real job in the great electrical industry. I'll show you how.

Be an Electrical Expert

Learn to Earn \$3,500 to \$10,000 a Year

Today even the ordinary Electrician—the "screw driver" kind—is making money—big money. But it's the trained man—the man who knows the whys and wherefores of Electricity—the Electrical Expert—who is picked out to "boss" the ordinary Electricians—to boss the big jobs—the jobs that pay \$3,500 to \$10,000 a year. Get in line for one of these "Big Jobs." Start by enrolling now for my easily learned, quickly grasped, right-up-to-the-minute, Spare-Time Home-Study Course in Practical Electricity.

Age or Lack of Experience No Drawback

You don't have to be a College Man; you don't have to be a High School Graduate. As Chief Engineer of the Chicago Engineering Works, I know exactly the kind of training you need, and I will give you that training. My Course in Electricity is simple, thorough and complete and offers every man, regardless of age, education or previous experience, the chance to become, in a short time, an "Electrical Expert," able to make from \$70 to \$200 a week.

Your Satisfaction Guaranteed

So sure am I that you can learn Electricity—so sure am I that after studying with me, you, too, can get into the "big money" class in electrical work, that I will guarantee under bond to return every single penny paid me in tuition, if, when you have finished my Course, you are not satisfied it is the best investment you ever made. And back of me in my guarantee, stands the Chicago Engineering Works, Inc., a two million dollar institution, thus assuring to every student enrolled, not only a wonderful training in Electricity, but an unsurpassed Student Service as well.

Free Book on Electricity

I want to send you my Electrical Book and Proof Lessons, both Free. These cost you nothing and you'll enjoy them. Make the start today for a bright future in Electricity. Send in Coupon—Now!

L. L. COOKE,
Chief Engineer

**Chicago
Engineering Works**
2150 Lawrence Ave.
Dept. 33 Chicago

**Get Started Now!
Mail Coupon**



**Pay Raised
150%**

"I was a dumbbell in electricity until I got in touch with you, Mr. Cooke, but now I have charge of a big plant including 600 motors and direct a force of 34 men—electricians, helpers, etc. My salary has gone up more than 150%."
GEO. ILLINGWORTH,
63 Calumet Road,
Holyoke, Mass.



\$700 in 24 Days

"Thanks to your interesting Course I made over \$700 in 24 days in Radio. Of course, this is a little above the average but I run from \$10 to \$40 clear profit every day, so you can see what your training has done for me."
FRED G. McNABB,
7 W. 16th St., Atlanta, Ga.



**\$20 a Day
—for Schreck**

"Use my name as a reference and depend on me as a booster. The biggest thing I ever did was answer your advertisement. I am averaging better than \$500 a month from my own business now. I used to make \$18 a week."
A. SCHRECK,
Phoenix, Arizona



L. L. COOKE,
Dept. 33
2150 Lawrence
Ave., Chicago

**GET
MY
FREE
BOOK!**

**The Man
Who Makes
"Big-Pay"
Men**

Send me at once without obligation your big illustrated book and complete details of your Home Study Course in Electricity, including your outfit and employment service offers.

Name.....

Address.....

Occupation.....

The "Cooke" Trained Man is the "Big Pay" Man

Opportunities for Readers in Quick Action Advertising

ADDING MACHINES

FREE trial, marvelous new adding machine. Adds, subtracts, multiplies, divides automatically. Work equals \$350.00 machine. Price only \$15.00. Speedy, durable, handsome. Five-year guarantee. Used by largest corporations. Write today for catalog and free trial offer. Lightning Calculator Co., Dept. O, Grand Rapids, Michigan.

ADVERTISING SERVICES

ADVERTISE in 24 metropolitan dailies, 24 words, \$15.00. Helpful Guide listing 1000 publications, 4c stamps. Wade Company, Baltimore Bldg., Chicago.

24 WORD ad 355 rural weeklies, \$14.20. Ad-Meyer, 4112P Hartford, St. Louis.

COMBINATION Winner, 125 Magazines, 10c word, \$8.00 inch. Thrice, Interstate Advertiser, Munising, Mich.

MODERATE price ad-copy. Sales Letters \$1.50, 3 x 6 Circulars \$1.00, 6 x 9 Circulars, \$2.50, 2-inch display \$1.00, classified 50c. Nelson, 402 Fairmount, Philadelphia, Pa.

INCH display, 88 magazines \$2.00, thrice \$5.40. Smith's Service, Wenatchee, Wash.

INCH Display, 100 monthlies \$4. Cope Agency, 233PS, Champaign, Ill.

AUTHORS AND MANUSCRIPTS

PHOTOPLAY—Story Ideas wanted. \$25-\$500 paid. Experience unnecessary; outline free to anyone. Write Producers League, 312, St. Louis.

WRITERS—Stories, poems, plays, etc., are wanted for publication. Literary Bureau, 117, Hannibal, Mo.

SONG Poem Writers send for proposition. Ray Hibbler, D10, 4040 Dickens Av., Chicago.

I WANT song poems. Casper Nathan, J-3544 No. Racine, Chicago.

\$\$\$ FOR IDEAS. Photoplay plots considered in any form. Write today for free booklet. Universal Scenario Corporation, 214 Security Bldg., Santa Monica & Western Ave., Hollywood, Calif.

AUTOMOBILES AND ACCESSORIES

CARBON-X will keep your engine "peppy" by keeping it free from carbon. Handy package and "Why Is Carbon?" postpaid for dollar bill. Money back if you want it. Carbon-X, Box 1953, Chicago.

AVIATION

LEARN Aviation: Send 25c for large illustrated booklet which tells how. Varney Aircraft Co., Peoria, Ill.

The American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 6741, 3601 Michigan Ave., Chicago, Illinois.

BOYS get a three foot model aeroplane free. Write to Aero Shop, 3050 Hurst Ave., Detroit, Mich.

AEROPLANE Motors \$3,000.00; complete 165 Horsepower Gnome 9-cylinder engine, weight 292 pounds, air cooled. Immediate delivery \$25.00; cash with order P.O.B. Dayton. 1,100 engines purchased from Air Service. Complete planes \$500 up. Time payments. Newport model. 28 wings complete, \$6.00; good condition—bargain for plane builders. Motors ideal for ice sleds, snow sleds, motor boats, wind wagons. Write for booklet. Marvin A. Northrop, 200 Builders Exchange, Minneapolis, Minn.

MOTORS: Curtiss OXX-6 Class A (under Fifty Hours) for Plane, Sea-Sled, Motor boat, etc., \$225.00. All Motor and Plane Spares at Best Prices. Send for Catalogue. Monumental Aircraft Co., 339 N. St. Paul Terrace, Baltimore, Md.

BOATS AND LAUNCHES

SPEEDY boat, Ford propelled, easily built, blueprint and directions; sixty cents. Marine cooler booklet free to Ford boat owners. C. C. Hubbell, 4D East Ave., Norwalk, Conn.

BUILD your own boat:—Newly designed Speedy V-Bottom Out-Board motor, Runabouts, Cabin/Cruisers, etc., 35 models KNOCK-DOWN or patterns. Send 25c for catalog. Brooks Boat Co., Inc., Salt Street, Saginaw West Side, Mich.

BLUE PRINTS

MOTOR CAMPERS. We supply camp car plans for amateur builders. Pacific Vehicle Works, Box 574, Los Angeles.

TO the man who has a Home Workshop and likes to work with tools, Popular Science Monthly offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1, Sewing Table, No. 5, Kitchen Cabinet, No. 13, Tea Wagon, No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 41, One Tube Radio Set, No. 42, Radio Receiver with three stages of amplification, No. 43, Four Tube Radio Receiver. Send 25c for each blueprint that you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

BUSINESS OPPORTUNITIES

BATTERY shop equipment and supplies at wholesale. Adams-Barrs, Columbus, Ohio.

A new mail order book tells exactly how to start, grow and win. Latest methods explained, new ideas and pointers. Free circular tells all about it. MacRea, Publisher, 8058 Oregonian Bldg., Portland, Oregon.

BIG money made repairing burnt-out Radio Tubes. Instructions \$1.00. Duck Mfg. Co., Freeport, Ill.

FREE Book. Start little mail order business. Pier, 976 Cortland Street, N. Y.

MANUFACTURE your own products. Make \$100 weekly. Information for stamp. Office: Thomas W. Myers, 21 W. Locust St., Mechanicsburg, Pa.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

Rates 30 Cents a Word. A 10% discount is allowed on all contracts for six consecutive insertions. Advertisements intended for the May, 1926 issue should be received by March 5th

BUSINESS OPPORTUNITIES

BUSINESS Guide with free legal service sells everywhere. Wells cleared \$1,185 in 35 days. Write for free outfit. Nichols Co., Naperville, Ill., Dept. 1B.

USED correspondence school courses. All kinds. Sold on re-purchase basis. Big saving. Money back guarantee. Lists free. (Courses bought.) Lee Mountain, Pisgah, Alabama.

MIRRORS re-silvered at home. Costs less than 5 cents per square foot; you charge 75 cents. Immense profits, plating auto parts, reflectors, tableware, stoves. Refinishing metal ware, etc. Outfits furnished. Write for information. Sprinkle, Plater, 94, Marion, Indiana.

LEARN the collection business. Good income; quick results. Interesting booklet, "Skillful Collecting," free. National Collector's Association, Science Building, Newark, Ohio.

BECOME a Foot Correctionist. A New Profession not medical nor chiropody. All the trade you can attend to; many are making \$3000 to \$10,000 yearly, easy terms for training by mail, no further capital needed or goods to buy, no agency or soliciting. Address Stephenson Laboratory, 10 Back Bay, Boston, Mass.

WE start you in business, furnishing everything; men and women, \$50.00 to \$100.00 weekly operating our "New System Specialty Candy Factories" anywhere. Opportunity lifetime; booklet free. W. Hillyer Ragsdale, Drawer 19, East Orange, N. J.

STOP plodding! Be successful. Operate a tire repair shop. Make big profits in any locality. We teach you and furnish complete equipments, \$100 up. Book of Opportunity free. Haywood's, 1306 South Oakley Avenue, Chicago.

MAKE \$100 to \$300 weekly locally and by mail in a fascinating high class business. Complete instructions sent for 25c. Address U. C. Service, Honesdale, Pa.

START small home Mail Order Business. Booklet 2c. Harvey Teeple, Decatur, Indiana.

SUCCEED With Your Own Products—Make them yourself. Formulas, Processes, Trade-Secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

RESPONSIBLE manufacturer wants competent men to manage office and salesmen. \$300 to \$1500 necessary; will allow expenses to Trenton if you qualify. Address Manager, 536 Forst Richey Bldg., Trenton, N. J.

BUSINESS of your own. Clean rugs. Same method I use. Plan and formula \$1.00. Good for \$10.00 daily. Pink, 1050 Curtis, Toledo, Ohio.

GO INTO business of your own at home or office earning good growing income, without investment or canvassing. Get free interesting details. Interstate Commercial Service, Box 263, Elizabeth, N. J.

A different business, worthy, remunerative. Learn privilege trading. Capital \$100 up. Dept. R., Paul Kaye, 149 Broadway, New York.

WANT more money? Start little Mail Order Business. Samples and Plan Free. Stamp please, Suydamp, 10748—112th Street, Richmond Hill, New York.

PATENTS procured: Trade Marks Registered—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.

MAKE \$10 a day, cleaning clocks without taking apart. Copyrighted instructions \$1. DeSelsma Watch School, Logansport, Indiana.

YOU can get the job you want. Sample letters of application and instruction \$1.00. A. Allard, 1217 Mary Ann, Montreal, Canada.

GO in Business for Yourself. Operate at home spare time. No canvassing. Very little capital required. Particulars free. Regal Service, 305-E 43rd, Kansas City, Mo.

MAKE \$80 weekly; experience unnecessary; full or spare time; details free. Winner, Box 615, Philadelphia, Pa.

GOOD Steady profits derived from retinning business. Our process gives best results. Rusted ice cream and milk cans must be retinned. Callender, 2529 W. 48th, Chicago.

THE Miracles of Hunches. Dr. Kroll's master pocket edition solves great mysteries and simplifies vital problems. These amazing secrets unfold the miracles of instinct to your immediate advantage or money refunded. Price \$1.00. Dr. Wm. F. Kroll, 20-N. Ashland Blvd. Suite 411, Chicago, Ill.

BUSINESS SERVICES

CHARTERS—Delaware; best, cheapest; granted day received; free forms. Colonial Charter Co., Wilmington, Del. (99)

MAKE 'Em Pay—My system will make them pay their bills. Write for the acid test. Literature free. Burleigh L. Horr, Horr Omelia Block, Rhinelander, Wis.

CHALK TALKS

LAUGH producing program, \$1.00. Circulars free. Cartoonist Balda, Oshkosh, Wisconsin.

DISTRICT MANAGERS AND REPRESENTATIVES WANTED

WORLD'S fastest selling auto accessory. County distributors wanted; write to-day. G. L. W., Spring Oiler Co., San Diego, California.

DOGS

BEAUTIFUL registered bull pups cheap. Bulldogs, 501 Rockwood, Dallas, Texas.

FOX, Coon, and combination hounds as good as live; Rabbit hounds, Stephens Kennels, Marshall, Ark.

EDUCATION AND INSTRUCTION

CORRESPONDENCE Courses. All Schools. Lowest prices. Terms. Catalog Free. Mention Subject. Economy Educator, 440-B Sansome, San Francisco.

USED correspondence school courses save over half. Bargain catalogue 1000 courses free. Used courses bought. Students' Exchange, Dept. A, 47 West 42d Street, New York.

"DOUBLE entry bookkeeping mastered in 60 hours with 8 keys; guaranteed; diploma." International Bookkeeping Institute, Desk 10, Springfield, Mo.

BOOKKEEPING in a week, \$2 complete. Dukes, 640 West 153d Street, New York.

FOR "Free Scholarship" (Mail Course) write Carnegie College, Rogers, Ohio.

CORRESPONDENCE Courses bought and sold. Handling, 799-X, Broadway, New York.

CORRESPONDENCE Courses sold complete; 1-3 usual prices because slightly used; easy terms; money back guarantee. All schools and subjects. Write for special Free catalog. Courses bought for cash. Economy Educator Service, 202-N. West 40th St., New York.

SHORTHAND in four evenings. Arthol course seven dollars. Sent approval. Particulars, Hollefreund's School, Stratford, Ontario, Canada.

BECOME Patent Lawyer. Full information. Patent Law, 301 Hennepin Ave., Minneapolis, Minn.

BARBERING. Learn modern barbering at home. Practice on the family. Easy complete instructions. Two dollars. Foster, Expert Barber, Dept. B, 613 E. 60th St., Chicago, Ill.

DOUBLE your earning power. You can quickly become a foreman under my training. I teach you to read blue prints and take charge of work. Write today—tell me your trade. Carrell Rumsey, 205 Dresel Building, Philadelphia, Pa.

FORMULAS

FORMULAS—ALL KINDS. Catalog Free. Clover Laboratories, Dept. PS, Park Ridge, Illinois.

FOR BOYS

"AMATEUR ELECTRICIAN," 64 pages, (illustrated) "Toymaker Book," (illustrated) "Ford Joke Book"—all for 25c. Elsea, Publisher, Bowling Green, Ohio.

FOR INVENTORS

CASHING IN—If you have a practical, useful invention to sell, write promptly. American Patents Corporation, Barrister Building, Washington, D. C.

INVENTOR'S Universal Educator—contains 900 mechanical movements; 50 perpetual motions. Tells how to obtain and sell patents. Suggests new ideas. Explains how to select your attorney and avoid patent sharks. Price (revised edition), \$2.00 postpaid. Albert E. Dietrich, 681 Ouray Bldg., Washington, D. C.

UNPATENTED Ideas Can be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted). Write W. T. Greene, 805 Jenifer Building, Washington, D. C.

INVENTIONS Commercialized. Patented or unpatented. Write Adam Fisher Mfg. Co., 183 Enright, St. Louis, Mo.

PATENTS: My fee in instalments. Free personal advice. Frank T. Fuller, Washington, D. C.

GET Your Own Patents. Instructions, legal blanks, \$1. Cooper Cutting, Campbell, Calif.

SELL your patented or unpatented invention. Write for my three plans. Free. Hartley, 44 Central St., Bangor, Maine.

PATENTS wanted by manufacturers; send description. Box 126, Dowagiac, Michigan.

INVENTORS: Get this pamphlet—"What to Invent". No theory or guess work, but things actually asked for by manufacturers. Sent prepaid for only \$1.00. Inventors' Syndicate, 23 Paladium Bldg., St. Louis, Mo.

FOR MEN AND WOMEN

DETECTIVES—Work home or travel. Experience unnecessary. Write, George Wagner, former Government Detective, 1968P Broadway, N. Y.

BEAUTIFUL handwritten cards, your name. Send quarter for sample dozen to EXPERT PENMAN MEUB, 2365 Mar Vista, Pasadena, Calif.

ARE you old at forty? See our advertisement on page 138 of this issue. The Electro Thermal Company, 4055 Main Street, Steubenville, Ohio.

\$15 daily easily made; great opportunity. Men and women—experience unnecessary. 95c Profit every Dollar. A Whirlwind Seller. Write Quick! Particulars free! Alfred P. Samson, Dept. 20, Willows, California.

FOR SALE

FOR Sale: Watchmaker's Lathe at a bargain. R. Jaegermann, 5815 Easton Ave., St. Louis, Mo.

25c BARGAIN—3 beautiful miniature cacti, with illustrated catalogue of Desert plants. C. E. Pattison, 320 Tobin Place, El Paso, Texas.

MR. MANUFACTURER, layman or veteran—Slide Dump Scraper Hoist, loads wagons, does ditching. E. B. Hawkins, Applegate, Ore.

PURE honey, guaranteed, five pounds, \$1.25 F.O.B. Here. Soo Tin, Liberty, N. Y.

FOR THE HOME

HOT WATER ON TAP, \$6. Make your own Automatic. Write John Kirkeby, San Luis Obispo, Calif.

MEN! WOMEN! MAKE \$1 AN HOUR AT HOME, WEAVING Colonial Rugs, genuine fluff rugs, fancy fabrics, from new and other materials. Home weavers always busy. You learn in 30 minutes. We guarantee it. Looms now as low as \$9.90. Liberal Pay-As-You-Weave terms. Solve YOUR more-money problem by writing for FREE Loom Book today. UNION LOOM WORKS, 482 Factory St., Boonville, N. Y.

3 Electrical Lessons *actually* FREE!

to prove you can learn at home in spare time



Get ready-Quick! for a big-pay Job in ELECTRICITY

I have placed hundreds of men in fine Electrical jobs at salaries from \$60 to \$125 a week. Several hundred more needed. They need not be high school graduates (the grades will do) but they must be willing to devote part of their spare time to learning Electrical principles and practice by a new Job-method built by 23 leading Electrical Engineers, and simplified for home-study. Three Lessons sent you absolutely free to prove how interesting and easy and valuable this instruction has been made.

I WILL make this Contract with you:

A million dollar institution stands back of this agreement to PREPARE you to fill a well-paid Electrical job and then to help you FIND THE JOB—or to refund the small amount charged for your training! Here is your opportunity to get out of the class of under-paid, money-worried men, always out of a job or afraid to lose one. To step into the rank of men who are paid BIG SALARIES for what they KNOW, instead of starvation wages for what they DO!

4 Costly Electrical Outfits Given!

I send you absolutely without extra cost, as a part of this training, 4 costly outfits of standard size tools and materials, so you learn Electricity by DOING actual Electrical jobs. One of these outfits is a \$10 Electric Motor—a real motor and generator, the same type

as the big fellows in a power plant. I send it to you "knock-down" and have you wind the field and armature and assemble it. *That's the way I teach every branch of Electricity!* House-wiring, Electric Light, Radio, and Motor outfits included.

Training Built by 23 Noted Engineers

This is no one-man, one idea school. America's leading Electrical Engineers have helped me build this wonderful home-training—men from

Westinghouse
Western Electric
American Tel. & Tel.
General Electric
Mass. Inst. Tech.
Columbia Univ.
and other leading corporations and universities



AMERICAN SCHOOL
— the Million Dollar Educational Institution



Your name here *Wm. C. Campbell*
When you enroll for my home-training in ELECTRICITY I agree to give you:

1. Complete training, including Electrical Engineering, Ignition, Radio, etc.
2. Four outfits of standard tools and materials, including a \$10 motor.
3. I WILL HELP YOU GET A GOOD JOB AND A RAISE IN PAY.
4. —or I will refund every cent of your money.

AMERICAN SCHOOL
By Chief Engineer *Dunlap*

Get My Job Service Guarantee Offer

If you have reached the point where you realize YOU MUST train and specialize to get anywhere, *write me immediately!* I will show you the wonderful opportunities, the enormous salaries, the many openings waiting in this billion dollar industry. I will tell you about the most sensational combination TRAINING-AND-JOB offer ever made, which is practically a guarantee of your success. Mail coupon and get 3 Free Electrical Lessons and complete information.

CHIEF ENGINEER DUNLAP
ELECTRICAL DIVISION

PROOF!

that we place men in JOBS!

"I received your letter today and hurried immediately to the Bodine Electric Company, with the result that I got the position."
John Almquist, Ill.

Louisiana Public Service Company
New Iberia, La.

"Under your caption G-045 you have a construction superintendent whom we might be interested in employing. Will you please put him in touch with us, or give us all necessary information regarding his character and qualifications."
J. G. Dix, President.

"I have just received a notification from the Commonwealth Edison Co. employment department to start to work in their generating station. I am very grateful to you for this help you gave me."
Jerome Overholt.

AMERICAN SCHOOL, Dept. Drexel Ave. and E375, 58th St., Chicago

3 Electrical Lessons Free!

CHIEF ENGINEER DUNLAP
ELECTRICAL DIVISION

American School, Dept. E375

Drexel Ave. and 58th St., Chicago

Send me your Job Service Guarantee offer, 3 Free Electrical Lessons, facts about the opportunities in Electricity, etc.

Name.....

Street No.....

City.....

State.....

FOR THE HOME

GRANDFATHER clock works \$5.00. Build your own case. Instructions free; make good profits selling your friends. Clock works with chains for old or new cases. Write for full particulars. Clock Co., Nicetown, Penn.

TO the man who likes to work with tools. Popular Science Monthly offers the opportunity to purchase blueprints giving details of the construction of useful articles for the home. The following are a few of the blueprints available: No. 1, Sewing Table, No. 5, Kitchen Cabinet, No. 13, Tea Wagon, No. 15, Workshop Bench, No. 17, Cedar and Mahogany Chest, No. 41, One Tube Radio Set, No. 42, Radio Receiver with three stages of amplification, No. 43, Four Tube Radio Receiver. Send 25c for each blueprint that you wish to Popular Science Monthly, 242 Fourth Avenue, New York, N. Y.

HELP WANTED

SILVERING Mirrors, French plate. Easily learned; immense profits. Plans free. Wear Mirror Works, 31 Excelsior Springs, Mo.

EARN \$10 to \$30 weekly mailing circulars at home. Outfit and instructions, 25c coin. Survival, 4731-2 S. Arlington, Akron, O.

MEN—Start with a starting concern. No get-rich-quick promises—As You Work So Shall You Earn. Kretan Corporation, 9629 Conant Ave., Detroit, Mich.

STEAMSHIP POSITIONS—Europe, Orient. Good pay. Experience unnecessary. Send stamped addressed envelope for list. Box 122-F, Mount Vernon, N. Y., or Box 356-F, Santa Monica, California.

MR. BRUSH Salesman—Old Established New York Brush Manufacturer requires the services of men in all territories to sell their extensive line of Sanitary Twisted in Wire Brushes. We pay larger commissions than any other Brush House in the country. Write immediately for our proposition. Wire Grip Sanitary Brush Corp., 15 Mercer St., New York.

HELP WANTED INSTRUCTION

DETECTIVES Earn Big Money. Excellent opportunity. Travel. Fascinating work. Experience unnecessary. Write George Wagner, former Government Detective, 1965P, Broadway, N. Y.

COMMENCE \$142—\$158 MONTH. Mail Carriers, Railway Mail Clerks. Men 18 up. Travel—see country. Sample coaching—FREE. Write immediately. Franklin Institute, Dept. N 34, Rochester, N. Y.

MEN wanting forest ranger, railway mail clerk and other government positions, write for free particulars of examinations. Mokane, Dept. B-30, Denver, Colo.

HOW TO ENTERTAIN

PLAYS, musical comedies and revues, minstrel music, blackface skits, vaudeville acts, monologs, dialogues, recitations, entertainments, musical readings, stage handbooks, make-up goods. Big catalog free. T. S. Denison & Co., 623 So. Wabash, Dept. 26, Chicago.

INCORPORATIONS

DELAWARE Incorporator, Charters. Fees Small; forms. Chas. G. Guyer, 901 Orange St., Wilmington, Delaware.

INDIAN GOODS

INDIAN Goods, curios, minerals, coins, stamps, butterflies. 1,000 article catalogue 10c. Indiancraft P. S. Company, 466 Connecticut, Buffalo, N. Y.

INFORMATION

\$1,000 worth information circular, Free. Lakeside Bureau, 80 Lake, Webster, Mass.

COMPLETE, accurate information on any subject, \$2. National Information Bureau, 1429B Milton St., Grand Rapids, Michigan. Prompt service.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

INSECTS WANTED

WHY not spend Spring, Summer and Fall gathering butterflies, insects? I buy hundreds of kinds for collections. Some worth \$1 to \$7 each. Simple outdoor work with my instructions, pictures, price-list. Send 10 cents (not stamps) for my illustrated prospectus before sending butterflies. Mr. Sinclair, Dealer in Insects, Dept. 7, Box 1424, San Diego, Cal.

LABORATORY AND CHEMICAL SERVICES

YOUR chemical problem solved and working process furnished for \$5.00. Write me. W. Stedman Richards, Consulting Chemist, Box 2402, Boston, Mass.

MELT Metals and Alloys. Electric furnaces \$75.00. Speedee-Heat Electric Furnaces, 411 N. Wells St., Chicago, Ill.

FORMULAS: The Best Chemical Science Can devise—Guaranteed Reliable Processes in all lines. Stamp Brings Big Bunch of Valuable Literature, Interesting Lists. Don't buy till you receive this. Chemical Analysis, Charges reasonable. Dr. Liscomb Miller, Chemist, Tampa, Florida.

EXPERIMENTERS. Complete Chemical Apparatus and Radio Catalog. 1000 illustrations. Price 25c; refunded on \$5.00 order. Laboratory Materials Co., 641 East 71st St., Chicago.

LANGUAGES

WORLD-ROMIC System, Masterkey 5,000 languages. Primers \$1.98. Chinese, French, Spanish—Languages, 8 West 40th, New York.

LEATHER GOODS

TRUNKS, Luggage, Leather Travel Goods. Buy from factory. Save money. Write for catalog. G. G. Mfg. Co., Spring Valley, Ill.

LISTS

NAMES, addressing, cuts. Ben Meyer, 35 West 31st St., New York.

NAMES and addresses, (live prospects), furnished for Mail-order Sales, 20c per 100, 75c per 1000, Business Service Bureau, 405 Caswell St., Smithfield, N. C.

MACHINE TOOLS

CONCRETE Building Block Machines and Molds, Catalogue free. Concrete Manufacturing Co., 5 N. Main St., St. Louis, Mo.

MAGIC TRICKS

BE a magician, give shows, earn money. Catalogue 20 cents. Oaks Magical Co., Dept. 520, Oshkosh, Wis.

BOOKS, Magic, Mysteries, Magic Tricks, Novelties. Catalogue Free. Singer 515, Hancock, Wisconsin.

BOOK of Magic. Set Trick Cards and Illustrated Catalog, 10c. Piedmont Novelty Shop, Box 631, Danville, Virginia.

MANUFACTURING

DEVELOPING ideas and manufacturing our specialty. Absolute satisfaction, 33 years' experience; write us. The K. & B. Die & Specialty Co., 2018 Elm St., Cincinnati, Ohio, Dept. C.

ADVICE from engineers will save you from making costly mistakes in buying radio and tool equipment. Write to Popular Science Institute, 246 Fourth Ave., New York City, for list of tested and approved products. See page 6.

MISCELLANEOUS

ARE you old at forty? See our advertisement on page 138 of this issue. The Electro Thermal Company, 4055 Main, Steubenville, Ohio.

MINERAL Treasure under foot! Find it! Cash it! Information 10c. Minerals Identified \$1.00. Mineral specimens. Buskin, Geologist, Joplin, Mo.

MODELS AND MODEL SUPPLIES

WE make working models for inventors and experimental work, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Pierce Model Works, Tinley Park, Illinois.

HULIT & CO., 625 Jackson, Chicago, Ill. Experimental Machinists. Model Makers, Dies. Patterns. Complete general Machine shop.

MODEL steam engines, boilers and model pipe line fittings. Model making supplies. Send 20c for this year's illustrated catalogue handbook. Bathe Mfg. Co., Dept. C, 5214 Woodland Ave., Philadelphia, Pa.

MOTORCYCLES, BICYCLES, SUPPLIES

OVERSTOCKED Used Motorcycles, 1923 Indian Chief, \$95.00, 1923 Harley Davidson, \$95.00, 1923 Henderson Deluxe, \$120.00. Two hundred others, write for free list. Myerow Brothers Co., 14 Berkeley St., Boston, Mass.

DON'T buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 4, Galesburg, Kansas.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

MAIL ORDER BUSINESS

\$3000 extra a year, home evenings, I made it. Mail Order Business. Advertising Booklet for stamp explains. Sample and plan 25c. Alps Scott, Cohoes, N. Y.

START a Mail Order Business. Reliable, practical plan 25 cents. Circulars free. Morris Specialty Co., 2007 Park Ave., St. Louis, Mo.

MUSICAL

SAXOPHONISTS — Clarinetists — Cornetists — Trombonists — get "Free Pointers." Virtuoso Music School, Buffalo, N. Y.

PIANO JAZZ: teaches Ear Playing, Negro Harmony, Player Piano Effects, Chimes, Blues, Chords, Sweet Harmony. Particulars Write "Piano Bill," Toronto 3, Canada.

NOVELTIES

BOOKS and imported French novelties. Sample and illustrated list 25c. Photo Institute, Box 519, McAdoo, Penna.

OFFICE DEVICES

ADDRESSING machines, multigraph, duplicators, folders, check writers, sealers, dictating machines, at about half new cost. Pruitt, 117 N. Market St., Chicago.

OPTICAL GOODS

ARTIFICIAL eyes. Booklet free. Denver Optic, 508 Barclay, Denver, Colorado.

PHOTOGRAPHY AND SUPPLIES

HAVE you a camera? Write for free sample of our big magazine, showing how to make better pictures and earn money. American Photography, 117 Camera House, Boston, 17, Massachusetts.

ESTABLISH yourself at home, as a photographic expert; make \$75 a week while learning; professional camera furnished free; write quick for full information. International Studios, Dept. 1743, 3601 Michigan Ave., Chicago.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

UNEXCELLED Gloss Prints. Trial Offer. Your Kodak Film Developed and Printed only 10c. F. R. B. Photographers, Dept. "G," 1503 Lincoln Ave., Cincinnati, Ohio.

MAKE photographs quickly, without plates. New process, saves money. Instructions \$1.00. Samples 10c. Satisfaction guaranteed. Koch's Studio, Colbran, Colo.

PATENT ATTORNEYS

PATENTS—Time counts in applying for patents. Don't risk delay in protecting your ideas. Send sketch or model for instructions or write for FREE book, "How to Obtain a Patent" and "Record of Invention" form. No charge for information on how to proceed. Communications strictly confidential. Prompt, careful, efficient service. Clarence A. O'Brien, Registered Patent Attorney, 184-K Security Bank Building (directly across street from Patent Office), Washington, D. C. (See page 143)

PATENT Book Free. Charles W. Lovett, Patent Attorney, Lynn, Mass.

SAMUEL Goldstein Registered Patent and Trade Mark Attorney—Formerly Member Examining Corps, U. S. Patent Office—Reasonable charges, 1440 Broadway, New York.

"INVENTOR'S Adviser," the valuable Patent book with 139 mechanical movements and illustrations, sent free upon request—M. S. Labiner, Patent Attorney, 3 Park Row, New York.

PATENT ATTORNEYS

PATENTS—Before disclosing an invention the inventor should write for our blank form "Record of Invention." This should be signed, witnessed and returned to us together with model or sketch and description of the invention for Free Inspection and Instructions. Our Three Books mailed free to inventors. Our illustrated Guide Book, "How to Obtain a Patent," contains full instructions regarding patents. Copies of unsolicited letters from manufacturers and others who are constantly writing us regarding the purchase or leasing of meritorious patents sent upon request. See advertisement on page 145. Victor J. Evans & Co., 937 Ninth, Washington, D. C.

PATENTS, trade marks, copyrights. Prompt, personal reliable service. Over 30 years' active practice. Write for terms. Book free. Address E. G. Siggers, Box 1, N. U. Building, Washington, D. C.

PATENTS. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 644 G Street, Washington, D. C.

INVENTORS' Guide free on request; gives valuable information and advice for all who have original ideas or improvements. Frank Lederman, Registered Attorney and Engineer, Woolworth Bldg., 1714, New York.

UNPATENTED Ideas Can Be Sold. I tell you how and help you make the sale. Free particulars (Copyrighted 1923). Write W. T. Greene, 811 Jenifer Building, Washington, D. C.

MILLIONS spent annually for ideas! Hundreds now wanted! Patent yours and profit! Write today for free book—tells how to protect yourself, how to invent, ideas wanted! how we help you sell, etc. American Industries, Inc., 501 Kresge Bldg., Washington, D. C.

PATENTS, Trade-Marks, all countries. Ten years' experience examining applications in Patent Office. Consultation invited. George Beeler, Patent Attorney, 150 Nassau Street, New York.

ESTABLISHED 1864. Milo E. Stevens Company, Free Booklet, Patents, Trade-Marks, Copyrights, Offices, Monadnock Block, Chicago; Barrister Building, Washington, D. C.

PATENTS: My fee in installments. Free personal advice. Frank T. Fuller, Washington, D. C.

MONROE E. MILLER, Ouray Bldg., Washington, D. C., Patent Lawyer, Mechanical, Electrical Expert, Booklet and Priority Record blank gratis.

PATENTS—Send for form "Evidence of Conception" to be signed and witnessed. Form, fee schedule, information free. Lancaster and Altwine, Registered Patent Attorneys in United States and Canada, 232 Ouray Bldg., Washington, D. C.

PATENTS Procured: Trade Marks Registered.—A comprehensive, experienced, prompt service for the protection and development of your ideas. Preliminary advice gladly furnished without charge. Booklet of information and form for disclosing idea free on request. Richard B. Owen, 44 Owen Bldg., Washington, D. C., or 41-Z Park Row, New York.

RICHARD E. Babcock, Patent Lawyer, Washington Loan & Trust Bldg., Washington, D. C. Established 1877. Booklet.

STRONGER patents at fair prices. Drawings, specifications, claims, \$20. Send half fee with description of invention. Prompt, efficient action. American Patents Corporation, Barrister Building, Washington, D. C.

As one of the oldest patent firms in America we give inventors at lowest consistent charge, a service noted for results, evidenced by many well known Patents of extraordinary value. Book, Patent-Sense, free. Lacey & Lacey, 648 F St., Wash., D. C. Estab. 1869.

PRINTING AND ENGRAVING

\$3.00 DELIVERED. 500 Watermarked Bond Letterheads, 8 1/2 x 11, and 250 envelopes, money with order. Job Printing Specialty. National Printing Company, Dept. S, Goshen, Ind.

HIGH Grade Printing—5,000 20-lb. Hammermill Bond Letter Heads, \$13.75; 10,000, \$24.00. 6 3/4 white wove envelopes, one thousand, \$2.25. The Courier Company, Zanesville, Ohio.

MONEY making business forms sent free. Cornish, Schenectady, N. Y.

200 Business Envelopes \$1.00. Commercial size, for business use. Name, business and address. Prompt service. List of 10 Big Dollar Specials Free. P. S. Kendall, Elmira, N. Y.

BETTER Printing for Less Money. Write us about your printing needs, and you will save money. Ernest Pantus Company, 525 South Dearborn Street, Chicago.

500 LETTERHEADS and Envelopes, \$5.00. Other printing cheap. Williams, 83, Aurora, Ind.

1,000 Letterheads, Envelopes, Cards, \$3.00 postpaid. 500, \$2.25. Samples Free. Artservis Press, 66 Houghton, Worcester, Mass.

"NEARGRAVURE" Process—1000 Business Cards, \$1.50. Postpaid. Solldays, Knox, Indiana.

PRINTING—Blinding—Electrotyping—Color Printing—Complete Service—Fine Work—We Save You Money. George Foster, Manager—4342 North Robey, Chicago.

PRINTING OUTFITS AND SUPPLIES

PRINT your own cards, stationery, circulars, paper, etc. Complete outfits \$8.85; Job Presses \$12, \$35; Rotary \$150. Print for others, big profit. All easy rules sent. Write for catalogue presses, type, paper, etc., Press Company, A-3, Meriden, Conn.

COMPLETE printing outfits, presses, type, ink, paper supplies. Write for Catalog. Press Company, C-3, Meriden, Conn.

REAL ESTATE—ORCHARDS

PECAN—Orange—Fig Groves. "On the Gulf" guaranteed care. Monthly payments. Big quick returns. Suburban Orchards, Dept. S, Biloxi, Miss.

SALESMEN AND AGENTS WANTED

BIG Money Selling "Jiffy Tire & Tube Repair Kit." Contains 3 Self-vulcanizing Tire Shoes. Large Outfit Tube Patch: 3 Puncture sealers, everything complete. Sells to every auto owner and Accessory Dealer. Agents average \$80 to \$100 weekly. We also manufacture Nationally known "Jiffy Tire-Doh." Exclusive territory and free samples. Chicago Tire Patch Co., 347-65 E. 55th St., Chicago, Ill.

CAN you beat this money making line? Big variety of shirts, including silks, with a splendid line of union made work and flannel shirts, overalls, coveralls, work pants, play suits, all guaranteed. Sell direct to wearer full or spare time. No experience required. Write today for FREE Selling Outfit, Nimrod Shirt Co., Dept. 25, 4922-24-26-28 Lincoln Ave., Chicago.

O. C. Miller
Director of
Extension
Work



3 Drafting Lessons Actually FREE!

I Will Make
This Con-
tract With
You!

To Prove You Can Learn at Home in Spare Time

We have invented a new, simplified way to teach Drafting—the first real improvement in Drafting home-instruction in history. We want you to see it, try it—without one penny of cost or obligation. We want to show you how we get away from the *copying* methods used in the past. See how we make you *think*, solve problems, do actual drafting room jobs from the first lesson.

Draftsmen Make \$60 to \$125 a Week

70,000 fine jobs advertised last year. Get ready to fill one. Get out of the rut. Make something of yourself. Plan your future in Drafting. Even if you have only common schooling, even if you know nothing of Drafting, we guarantee to make you a real Draftsman or to **refund your money!** Special surprise offer right now to the first 500 men who answer this ad—reduced price, easy terms. Coupon brings complete information.

A New, Rapid, Simplified Training

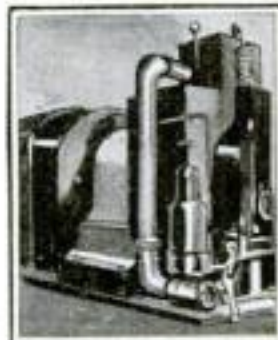
Copying drafting lessons prepares you to be only a "tracer." This new "Job-Method" gives you actual drafting-room jobs in a new one-step-at-a-time way. With pictures which you can understand almost without reading the "lessons." And that is why American School-trained Draftsmen can qualify for a good job at big pay when they graduate.

5 Big-Pay Branches

The big money in Drafting goes to men who specialize in Machine Design, or Electrical Drafting, or Architectural Drafting, or Structural, or Automotive. It isn't enough merely to know *general* Drafting practice. You must know how to calculate and design and plan original work. You need many Engineering subjects to fill the kind of a Drafting position that pays \$60 to \$125 a week. The American School now includes this specialized training in its Drafting course.

Coupon Brings 3 Lessons FREE!

Get them. Test your own ability to learn Drafting and get ready for a fine job and big pay. Coupon also brings surprise offer, and complete information about your opportunities for success in Drafting. **MAIL IT TODAY!**



Electricity needs Draftsmen who know Electrical principles in addition to general Drafting practice. I give you this training.



The demand for Draftsmen experienced in Structural Steel and Concrete work is enormous. All large structures require Draftsmen who can calculate and design the steel and concrete frame-work. Many positions open, enormous salaries offered.



Every great Auto factory employs Draftsmen who specialize in Automotive work. Men who design bodies, men who can plan and calculate engines, transmissions, automatic machinery, etc.

Your Name Here

When you enroll for our home-training in Drafting, we agree to give you:

1. Complete Drafting training, by the new Practice-Method.
2. Professional Drafting Outfit, as illustrated.
3. We will help you get a good Drafting position at a substantial increase in pay.
4. or we'll refund every cent of your money.

O. C. Miller
Director of Extension Work



AMERICAN SCHOOL
—the Million Dollar
Educational Institution



The American School, a million dollar No-Profit Educational Institution, now offers men a *double service*—training for a specific job, then finding the job. For one small price, on terms of only \$5 a month, you are now assured of definite benefits, both in position and salary.

Win Success Thru Drafting

Drafting is easy, fascinating work. Short hours. Big pay. And the Draftsman is always in line for promotion to executive positions. This training is complete. It includes high-school subjects (if you need them) and all the Engineering and Mathematics required of Drafting Experts.

FREE Job Service

The American School now offers its students and graduates, without cost, the services of an efficient Employment Department which keeps in touch with the employers of Draftsmen all over the United States. We have placed hundreds of men in good Drafting positions. We have made this training so complete, so practical, so easy to master, that our students are bound to make good. And, so, because the demand for real Draftsmen continues to exceed the supply and because this training actually prepares men for good Drafting positions, we back it with a **Free Employment Service**, free to employers, students, graduates.



No machine can be built until the Draftsman first builds it on paper. Thousands of Draftsmen are needed in the great manufacturing plants, at big salaries. My training prepares you for these positions.



Never before has the world seen anything like the building boom of today. And this has created an enormous demand for real Draftsmen, capable of designing and calculating original work. I will prepare you for one of these fine positions at home, in your spare time.



O. C. MILLER,
Director
Extension Work
Dept. D-375

Complete Costly Drafting Outfit GIVEN

Fine, imported instruments like these help you learn Drafting quickly and easily. These standard quality, full size instruments, board, table, triangles, T square, ink, protractor, etc., given without extra charge to every student.

AMERICAN SCHOOL Drexel Ave. and 58th St., Chicago

3 Drafting Lessons Actually FREE!

O. C. MILLER, Director Extension Work,
AMERICAN SCHOOL,
Dept. D-375, Drexel Ave. & 58th St., Chicago

Rush 3 Free Drafting Lessons, Job Service Guarantee offer, Complete information, Money back Guarantee, to prove I can become a real draftsman at home in spare time.

Name.....
Street No.....
City.....State.....

SALESMEN AND AGENTS WANTED

AGENTS—Write for free samples. Sell Madison "Better-Made" Shirts for large Manufacturer direct to wearer. No capital or experience required. Many earn \$100 weekly and bonus. Madison Co., 566 Broadway, New York.

AGENTS—Clever invention! Inkspoon makes every pen a fountain pen. Fast office seller, big profit, demand increasing everywhere. Exclusive territory offered. Sample free. H. Marul Company, Tribune Bldg., New York.

INSTANT Weld—Repairs large punctures without cement or heat. Lenn's profit one day \$50. Write quick. Free sample. Territory going fast. Tourist's Pride Mfg. Co., Desk R, Minneapolis, Minnesota.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

GET our free sample case toilet articles, perfumes and specialties. Wonderfully profitable. La Derma Co., Dept. F., St. Louis, Missouri.

WASH clothes the new way. Use the Torrent Automatic Washer. You will be delighted. Special offer to one in each locality. Storm Royalty Co., 3614 Enright Ave., St. Louis, Mo.

300% PROFIT Selling Mitchell's Magic Marvel Washing Compound. Men and women clearing hundreds weekly. Wonderful seller. Big repeater. Nature's mightiest cleanser. Free sample. L. Mitchell, Drawer 1308, E. 61st Street, Chicago.

AGENTS. \$60—\$200 a week. Genuine gold letters for store windows easily applied. Free samples. Liberal offer to general agents. Metallic Letter Co., 434-A, N. Clark, Chicago.

GET our plan for monogramming automobiles, trucks, hand luggage and all similar articles by transfer method, experience unnecessary; exceptional profits. Motorists' Accessories Company, Mansfield, Ohio.

POLMET POLISHING CLOTH cleans all metals. Sells fast at 25c. Sample free. F. C. Gale, 15 Edinboro St., Boston.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

SELF-THREADING Needles find sales in every home. Fine side line; easily carried; big profits; sample free. Lea Brothers, 147 East 23rd St., New York.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

TAKE orders for coffee, sugar, flour, meats, canned goods, staple groceries, also paints, radio sets, tires, auto and tractor oils. No capital or bond required. We deliver and collect. Permanent business. Big pay. Write at once. Hitchcock-Hill Co., Dept. 81, Chicago.

BANKRUPT and Rummage Sales. Make \$50.00 daily. We start you, furnishing everything. Distributors Dept. 34, 609 Division, Chicago.

AGENTS—Steady income. Large manufacturer of handkerchiefs and dress goods, etc., wishes representative in each locality. Factory to consumer. Big profits, honest goods. Credit given. Send for particulars. Freeport Mfg. Co., 24 Main St., Brooklyn, N. Y.

\$10 DAILY silvering mirrors, plating and refinishing lamps, reflectors, autos, beds, chandeliers by new method. Outfits furnished. Write Gunmetal Co., Ave. F, Decatur, Illinois.

AGENTS—Best seller; Jem Rubber Repair for tires and tubes; supersedes vulcanization at a saving of over 800 per cent; put it on cold, it vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or tube; sells to every auto owner and accessory dealer. For particulars how to make big money and free sample, address Amazon Rubber Co., 504 Amazon Building, Philadelphia, Pennsylvania.

SELLS for \$9.75. Prints ad on wrapping paper, envelopes, etc. \$4.00 commission. Send 10c for sample work. Automatic Ad-Stamp, Joplin, Mo.

LIGHTNING Electrolyte. Charges storage batteries instantly. Guaranteed not to injure battery. Gallon costs 50c sells \$10.00. Chance to clean up fortune selling to garages and agents. Make it yourself. Guaranteed formula \$5.00. Write for free circulars. Murphy, Chemist, Tujunga, Calif., Box-K.

AGENTS. New Selling Plan! \$1.25 premium free to every customer on a \$2.00 sale, consisting of 8-oz. Vanilla, 6-oz. Shampoo, 4-oz. Lemon Lotion. A big hit everywhere. Complete details free. Territory going fast. Write today. The C. I. Togstad Company, Dept. 19-C, 29 South Clinton St., Chicago, Ill.

FREE Booklet describes 52 plans for making \$20.00 to \$100.00 weekly in home or office business of your own. Downs Co., 2330 Myrtle, St. Paul, Minn.

A BUSINESS of your own. Make and sell chipped glass name and house number plates, checkerboards, signs. Booklet FREE. E. Palmer, Dept. 513, Wooster, Ohio.

REPLATE brassy worn-off automobile parts. Reflectors. Bathroom fixtures, worn spoons, forks, etc., with pure silver. Look like new. Use U-Kan-Plate Polish. Positively no mercury. \$1.00 half pint. Postpaid. Satisfaction guaranteed. Agents wanted. U-Kan-Plate Co., Dept. B, Philadelphia.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

ONE CENT!! Post Card from You Brings free solid gold stud offer to Agents. Rajah Rainbow Gem Deceives experts. Rainbow Gem Co., Dept. F-10, Salisbury, N. C.

NO dull times selling food. People must eat. Federal distributors make big money; \$3,000 yearly and up. No capital or experience needed; guaranteed sales; unsold goods may be returned. We furnish you with license. Your \$20.00 starting order sent on trust. **FREE SAMPLES** to customers. Repeat orders sure; Exclusive territory. Ask now! Federal Pure Food Co., L-2311 Archer, Chicago.

SALESMEN AND AGENTS WANTED

AN UNUSUAL opportunity—Earn \$75.00 weekly and bonus taking orders for Nustle guaranteed Hosiery. Sample outfit furnished. Full or spare time. Write now. The Nustle Company, Dept. 4-12, Philadelphia, Pa.

SUCCEED With Your Own Products—Make them yourself. Formulas, Processes, Trade-Secrets. Modern master methods. Catalog free. C. Thaxly Co., Washington, D. C.

OVER 110% profit, self-lighting gas and cigar lighters: Everybody interested; repeat business. Sell individuals, dealers, subagents. Particulars free. S. M. Bernhardt, 148 Chambers St., New York.

SELL "Everyday Greeting Cards." Boxed. 35% commission. Soliciting folder, 10c. Wolfprint, Lawndale, Philadelphia.

BUILD splendid business making chipped glass number and name plates. Particulars free. Simplex Co., Dept. 83, 1133 Broadway, New York.

\$20 DAILY selling VER-I-EZY Men's shoes direct. Sell relatives, friends, neighbors first. Low priced. Give real comfort, long service. You take orders, keep big commission. We ship and collect. Full or part time. Write NOW. Easy-wear Shoe Company, Dept. 233, Indianapolis, Ind.

WHY Buy Other's Goods? Start your own Profitable business making them. Free Valuable Literature, explains all including Chemist's Lists Guaranteed Reliable Money Making Formulas. All Lines. No "Master Formulas" junk or "dollar" recipe-book trash. Miller, Chemist, 1706-Jetton-R, Tampa, Florida.

SALESMEN: Write your name and address on a card and mail to us. We'll show you sure earnings of \$20.00 a day. Will you risk one minute and a one-cent stamp against \$20.00? Mind you, we say we'll show you. Address Sales Manager, 850 W. Adams St., Dept. 803, Chicago, Ill.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Ave., New York.

AGENTS WANTED—Something new—Fyr-Fyter sells easily. Makes a spectacular demonstration; car owners, homes, factories, stores, practically buy on sight. Our men make \$10 to \$50 a day. Exclusive territory to producers. If you wish to establish a business of your own with unlimited possibilities for making big money, write us today. Fyr-Fyter Co., 999 Fyr-Fyter Bldg., Dayton, Ohio.

FREE: A beautiful 5 tube tuned radio frequency receiver, to the first man in each community who answers this ad within 10 days. Write now for particulars. A nationally advertised loud speaker will be sent free every Monday morning for the first letter opened. E. Parker, Putnam St., Peabody, Mass.

AGENTS sell Alward's Egyptian Dream Incense for quick sales and big profits. Send for wholesale price list with free sample. Telchert Incense Co., 2402 Bronson Ave., Los Angeles, Calif.

LIGHTNING storage battery compound. Charges discharged batteries instantly. Eliminates old method entirely. Gallon free to agents. Lightning Co., St. Paul, Minn.

WONDERFUL INVENTION! Eliminates phonograph needles. Preserves records. Abolishes scratching. 14,000,000 prospects. \$20 daily. Supply in pocket. Sample on approval if requested. Everplay, Desk, G-3, McClurg Bldg., Chicago.

NEWEST INVENTION! Sells every office, home, store. Automatically coils telephone and iron cords. Abolishes snarls and kinks. Great time and temper saver. \$25 daily. Samples for test if desired. Never-knot, Dept. 3-9, McClurg Bldg., Chicago.

ACTIVE men and women wanted as distributors and sales managers. Exclusive territorial rights. Pays 150 to 250 per cent profit. Darn E-Z Laboratories, Department P.S., Dayton, Ohio.

\$100 WEEKLY—Pleasant Work: Appointing local agents to introduce Mother Hubbard Foods; no canvassing; no delivering; no money invested. Mother Hubbard, 556 Congress, Chicago.

AGENTS: \$65 to \$100 a week. High grade all wool suits made to measure \$25 and \$30. Biggest commission in advance. Money back-guarantee. Free sample outfit. Write C. G. Ferrin, Mgr., Box 1097, Chicago.

AGENTS make \$100 weekly placing advertising Cigar lighters with glass front. Every dealer wants one. Write for free plan. Drake Mfg. Co., Dept. P, Milwaukee, Wis.

\$20 PROFIT daily selling needlebooks; costs 3-5c each; sells 25c. value 50c. Three samples 25c. Catalogue free. Needlebook Specialty Co., 661 Broadway, New York.

DISTRICT salesman for union made, hand tailored, all wool suits and overcoats at \$23.50. Prefer married man with sales experience. \$35 weekly to start. Apply N. A. Harvey, Mgr., Box 90, Chicago.

SELL BY MAIL! Big Profits! Books, Formulas, Novelties, Bargains. Particulars Free! Elfeo, 523 South Dearborn Street, Chicago.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

BIG money and fast sales. Every owner buys gold initials for his auto. You charge \$1.50; make \$1.35. Ten orders daily easy. Write for particulars and free samples. American Monogram Co., Dept. 47, East Orange, New Jersey.

ARE you old at forty? See our advertisement on page 138 of this issue. The Electro Thermal Company, 4055 Main, Steubenville, Ohio.

BRING Home the Bacon selling Stuart's famous Food Flavors. Quick sellers. Big profits. Write for free sample and terms. C. H. Stuart & Co., 6568 Main, Newark, New York.

GET INTO BUSINESS FOR YOURSELF
Make storekeeper's profits without storekeeper's troubles. We'll show you how. In fact, we'll put you into business, furnish everything you need, train you, carry stock for you without your investing a penny. We'll work with you until we've made you a success. We have done it for others. We'll do it for you—provided you are honest, ambitious and willing to work hard. If you are, write us. You'll hear from us at once with **FACTS**. Address Dept. 201, GOODWEAR Chicago, Inc., 844 West Adams St., Chicago.

SALESMEN AND AGENTS WANTED

WE pay \$200 Monthly Salary, furnish car and expenses to introduce our guaranteed poultry and stock powders, cleaner, etc. Bigler Company, X371, Springfield, Illinois.

WORLD'S Largest Neckwear Manufacturer wants Agents. Remarkable opportunity. Immediate commissions 32½%. Advance Styles, complete line. Greatest values. Beacon, 3511 Beaconwear Bldg., Boston, Mass.

LIVE wire Salesmen wanted—only thoroughly experienced specialty men need apply who will give full time calling on small town dealers. New merchandising sales plan good for better than one hundred and fifty dollars weekly. Give your experience and previous lines sold in first letter for preferred attention. An abundance of opportunity for reliable, honest men. For particulars write P. O. Box 2619, Boston, Mass.

IMMENSE Profits Silvering Mirrors at Home. Plating like new, brassy worn-off autoparts, reflectors, tableware, stoves, refinishing metalware, etc. We train you. Plans FREE. Sprinkle, Plater, 96, Marion, Indiana.

AGENTS: \$11.80 daily in advance (Send for sworn proof) Introducing New Insured Hosiery. 57 styles, 40 colors, guaranteed seven months. No capital or experience required. You simply take orders. We deliver and collect (or you can deliver, suit yourself) Credit given. **PAY YOU DAILY**, monthly bonus besides. Spring line now ready. We furnish samples. Spare time will do. Maccohee Textile Company, Card 1523, Cincinnati, Ohio.

BIG Money monogramming autos, trunks, bags, etc. Make \$20 to \$25 daily. No experience needed. Samples, information free. Acme Products. 905 Broad, Newark, N. J.

AGENTS—No canvassing. No Delivering. No Money Invested. Pleasant Work. Big Money. Appointing Local Agents to Introduce Welcome Foods. Welcome Products, 326 Harvey, Illinois.

300% PROFIT. Quick Seller: Fast Repeater. Sample Free. "Bestever" Products, 1946-N, Irving Park, Chicago.

AGENTS. Amazing New Fire Gun. Brings \$4 to \$50 profit per sale. Beginners and experienced men make \$100 to \$300 week, spare and full time. Write for cash bonus and FREE sample outfit offer. Weldon Manufacturing Co., Dept. B-702, Grand Rapids, Mich.

WE pay \$48 a week, furnish auto and expenses to introduce our Soap and Washing Powder. Buss-Beach Company, Dept. A48, Chippewa Falls, Wis.

AGENTS—Stamping names on Pocket Key Protectors: sample check with your name and address, 25c. Stamping Outfits, Emblem Checks, Check Fobs, Name Plates, Hart Mfg. Co., Desk 2—305 Degraw St., Brooklyn, N. Y.

Sales Manager for largest Eastern Tailoring House. To secure direct sales force. Superior line \$29.50 up. Extra trousers free. Large commissions. N. E. Wholesale Tailors, Harrison Ave., Boston, Mass.

DISTRICT MANAGER—Largest New England House. Suits, overcoats \$23.50 factory to wearer. Largest commissions. Possibilities \$5000 up. Boston Wholesale Clothing, 47 Beach, Boston.

TAILORING Salesmen. Largest line made to order union label suits, overcoats. Special! Suit or overcoat \$24.50. Extra trousers free. Commissions \$4—\$8 every sale. Big sales outfit free. Scott System, 597 W. Washington St., Boston, Mass.

A PAYING Position Open to representative of character. Take orders shoes-hosiery direct to wearer. Good income. Permanent. Write now. Tanners Shoe Mfg. Co. 1-412 C. St., Boston, Mass.

YOUR trade uses salesboards. Make up to \$35 on single sale. Largest, lowest priced line. No samples to carry. Elaborate 3 color catalog free. Lincoln Sales Co., Dept. G, 9 So. Clinton, Chicago.

EDMUND REH & CO., Inc. Wholesale tailors are now making all wool cut and tailored to measure suits to sell at \$24.75. Entire line one price, worsteds, cashmeres, chevots, tropical weights, topcoatings, sport suits, choice of 30 style fashions at \$24.75. The outstanding value in popular price tailoring of this age, that will meet any legitimate competition. Liberal commissions, cash bonuses. We are interested only in men who make direct selling a business, part or full time. For further information write EDMUND REH & CO., Inc. Dept. DD., 415 So. Wells, Chicago.

For steady pleasant income sell old reliable herb medicine. Full time or side line. Makes friends and boosts everywhere. Extra fine commissions. Free box and agency terms. Write Bassett's Native Herbs Company, Established 1879, Dept. L, Columbus, Ohio.

MAKE Money, silvering mirrors, refinishing auto headlights, tableware; metal plating, bedsteads, chandeliers. Outfits furnished. International Laboratories, Dept. 64, 309 Fifth Ave., New York.

MAIL ORDER and Agency propositions, including large imprint catalog FREE. Pruitt Publishing Co., Station E-6, Kansas City, Mo.

SALESMEN and Agents: Write for big, Money-Making offer selling Suits and Overcoats. Made to Measure; easy sales. Preuss Tailoring Co., 303 5th Ave., New York City.

SALESMAN calling on garage and repair shops to sell new patented universal socket wrench. Every mechanic needs it. Write for particulars. York Wrench Co., 2413 N. Ashland Ave., Chicago.

A LARGE Hosiery concern wants responsible men and women as local Representatives working spare time. Big success. Write for details. Jennings Co., Dept. 432, Dayton, Ohio.

EVERY Autoist will buy Auto Mitten Dusters. Costs 25c; sell for 75c. National Fibre Broom Co., St. Louis, Mo.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

AGENTS—Make a dollar an hour. Sell Mendets, a patent patch for instantly mending leaks in all utensils. Sample package free. Collette Mfg. Co., Dept. 467, Amsterdam, N. Y.

EARN \$10 daily silvering mirrors, plating and refinishing metal ware, headlights, chandeliers, bedsteads. Outfits furnished. F. Dele Laboratories, 1133 Broadway, New York.

SALESMEN AND AGENTS WANTED

AGENTS—Our newly assembled 1926 Spring line of silks, dress goods, wash goods, curtain materials and drapery fabrics is larger and more complete than ever. No investment or experience required. Collect liberal commission in cash as you go along. Write for details. Dept. PS-3 International Home Fabrics Co., 235 Fourth Ave., New York.

BE your own boss. Built permanent business. Take orders men's—boys' tailored suits—\$13.95—\$22.50—\$4 commission. Free outfit. Fashion Clothing, 2654-P Lake, Chicago.

QUIT ringing doorbells. I made \$800 monthly, no soliciting, no goods to buy. Why not you? Details free. R. McNown, 319 Wilkinson, Omaha, Neb.

I MADE \$200 weekly Selling By Mail; began with \$5. Free particulars tells how. Peerless Service, Waterville, Maine.

AGENTS—Steady income. Large manufacturer of soaps, perfumes, toilet articles and pure food products, etc., wishes representatives in each locality. Manufacturer direct to consumer. Big profits. Honest goods. Whole or spare time. Cash or credit. Send at once for particulars. American Products Co., 5788 American Bldg., Cincinnati, Ohio.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

MAGIC Polishing Cloth—Great seller. Big Profit. Free sample to workers. Get this proposition. Newton Co., 107 Main St., Newark, New York.

STAMMERING

ST-TUT-T-T-TERING and stammering cured at home. Instructive booklet free. Walter McDonnell, 59 Arcade, 1126 Granville Avenue, Chicago, Ill.

STAMPS AND COINS

50 DIFFERENT stamps free to approval applicants. Rubin Huffman, 405 Pennsylvania Ave., Brooklyn, N. Y.

1000 DIFFERENT stamps only 75c; from Armenia, Iceland, Zanzibar, etc., to approval applicants only. Bargain lists free. Victoria Stamp Co., London, Canada.

CALIFORNIA gold 8 1/4 size, 2c.; 8 1/2 size, 53c. White cent and catalogue, 10c. Norman Schultz, Colorado Springs, Colorado.

STAMPS, 105 China, etc., 2c. Album (500 illustrations) 3c. Ballard, Station AA, Boston.

UNITED STATES—55 different (special issues, etc.), 10c; Borneo Rhinoceros and 105 different, Foreign, Hinges etc., 10c. Moseley, 4521 Parkview, St. Louis, Mo.

STAMPS, 100. All different, 3 cents. Lists free. P. S. Quaker Stamp Co., Toledo, Ohio.

1,000 DIFFERENT stamps, \$1.00. Fred Onken, 630 79th Street, Brooklyn, N. Y.

OLD Coins. Large Spring Selling catalogue of coins for sale free. Catalogue quoting prices paid for coins, ten cents. William Hesselein, 101B Tremont Street, Boston, Mass.

ZAMBESIA, Zanzibar, Abyssinia, Travancore, Herzegovina, Stamps, Menagerie Collection. Album, 10c. Liberty. 3974 Arsenal, St. Louis, Missouri.

1,000 MIXED U. S. and Foreign Stamps 25c. Phil Lundsted, Cape Cottage, Maine.

STAMPS Free—Ask for money-saving approvals. John K. Borresen, Cedar Falls, Iowa.

FREE! 12 scarce Azerbaijan to approval applicants. Pennsylvania Stamp Co., Manor, Pa.

30 all different unused stamps to approval applicants 6c. A bargain. W. H. Peck, Penryn, California.

TYPEWRITERS AND SUPPLIES

TYPEWRITERS: all makes; lowest prices; 5 year guarantee; send for illustrated catalogue. Henry Typewriter Co., 217 West 125 Street, New York, N. Y.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Address your inquiry to: Manager, Classified Advertising, Popular Science Monthly, 250 Fourth Avenue, New York.

WANTED

DETECTIVES needed everywhere. Experience unnecessary. Particulars free. Write, George Wagner, former Government Detective, 1968P Broadway, N. Y.

WANTED—Representatives in every factory in the United States. Popular Science Monthly, 250 Fourth Ave., New York.

\$100 in Cash Prizes

For the best letter of 150 words or less answering the question—"What advertisement in the 'Money Making Opportunities' Section interests you most and why?" First read every advertisement in the "Money Making Opportunities" Section on pages 128 to 158. Pick out the one that interests you most and write a letter not exceeding 150 words telling us why you find the advertisement you have selected the most interesting.

See page 4 for last month's prize winning letters and additional information about this contest.



They Called Me a "Human Clam" But I Changed Almost Overnight

AS I passed the President's office I could not help hearing my name. Instinctively I paused to listen. "That human clam," he was saying, "can't represent us. He's a hard worker, but he seems to have no ability to express himself. I had hoped to make him a branch manager this fall, but he seems to withdraw farther and farther into his shell all the time. I've given up hopes of making anything out of him."

So that was it! That was the reason why I had been passed over time and again when promotions were being made! That was why I was just a plodder—a truck horse for our firm, capable of doing a lot of heavy work, but of no use where brilliant performance was required. I was a failure unless I could do what seemed impossible—learn to use words forcefully, effectively and convincingly.

In 15 Minutes a Day

And then suddenly I discovered a new easy method which made me a powerful speaker almost overnight. I learned how to bend others to my will, how to dominate one man or an audience of thousands. Soon I had won salary increases, promotions, popularity, power. Today I always have a ready flow of speech at my command. I am able to rise to any occasion, to meet any emergency with just the right words. And I accomplished all this by developing the natural power of speech possessed by everyone but cultivated by so few—by simply spending 15 minutes a day in the privacy of my own home, on this most fascinating subject.

There is no magic, no trick, no mystery about becoming a powerful and convincing talker. You, too, can conquer timidity, stage fright, self-consciousness and bashfulness, winning advancement in salary, popularity, social standing, and success. Today business demands for the big, im-

portant high-salaried jobs, men who can dominate others—men who can make others do as they wish. It is the power of forceful, convincing speech that causes one man to jump from obscurity to the presidency of a great corporation; another from a small, unimportant territory to a salesmanager's desk; another from the rank and file of political workers to a post of national importance; a timid, retiring, self-conscious man to change almost overnight into a popular and much applauded after-dinner speaker. Thousands have accomplished just such amazing things through this simple, easy, yet effective training.

Send for This Amazing Book

This new method of training is fully described in a very interesting and informative booklet which is now being sent to everyone mailing the coupon at right. This book is called *How to Work Wonders with Words*. In it you are shown how to conquer

stage fright, self-consciousness, timidity, bashfulness and fear—those things that keep you silent, while men of lesser ability get what they want by the sheer power of convincing speech. Not only men who have made millions but thousands have sent for this book—and are unstinting in their praise of it. You are told how to bring out and develop your priceless "hidden knack"—the natural gift within you—which will win for you advancement in position and salary, popularity, social standing, power and real success. You can obtain your copy absolutely free by sending the coupon.

**NOW
SENT
FREE**



NORTH AMERICAN INSTITUTE

3601 Michigan Ave., Dept. 1363, Chicago, Ill.

North American Institute,
3601 Michigan Ave., Dept. 1363,
Chicago, Illinois.

Please send me FREE and without obligation my copy of your famous book, *How to Work Wonders With Words*

Name

Address

City..... State.....

FASCINATING



... and perhaps you, like other ambitious men, due to the lack of money, time and education necessary to master difficult mechanical trades, wonder what you can get into quickly and make the most out of, now! Haven't you overlooked the very thing you are looking for? For there

Address the branch of the **MOLER SYSTEM OF COLLEGES** nearest you
(Street address not needed)

Chicago, Ill.
New York, N. Y.
St. Louis, Mo.
Kansas City, Mo.
Cincinnati, Ohio
Cleveland, Ohio
Fargo, N. D.

Detroit, Mich.
Denver, Colo.
New Orleans, La.
Omaha, Nebr.
Milwaukee, Wis.
Atlanta, Ga.

Memphis, Tenn.
Dallas, Tex.
Houston, Tex.
San Antonio, Tex.
Minneapolis, Minn.
Seattle, Wash.

Los Angeles, Calif.
Salt Lake City, Utah
San Francisco, Calif.
Tacoma, Wash.
Portland, Ore.
Winnipeg, Man., Can.
Toronto, Ont., Can.

is a profession begging for clean-cut, earnest men, like yourself! Look into it 60,000 Moler graduates know Modern Barbering is easy to learn, inexpensive, quicker to earn, clean and FASCINATING! It pays better than you think! FIND OUT! Write for booklet C3.

Grand Prize Awards Will Appear Next Month

IN NEXT month's issue will appear the names of winners of Grand Prizes in our great \$10,000 "What's Wrong" contest. The awards, totaling \$6,000, include a First Grand Prize of \$2,500; a Second Prize of \$1,000, a Third Prize of \$500, and 305 lesser prizes. Watch for the April issue, published March 10.

Food for Thought Necessary

FOR thought, you need food. This is indicated by an interesting series of experiments recently carried out by J. A. Glaze of the University of Chicago. He tested three persons, two men and one woman, who had gone from 10 to 33 days with no nourishment but water, to find out whether or not they could do clearer thinking on an empty stomach.

In five tests out of seven, their mental efficiency, he found, decreased during the fast. After the fast was over, however, and food taken again, the subjects seemed to have greater mental activity.

During the first week of fasting, the subjects felt weak, but after that they regained strength.

Recent Publications

The Origin, Nature and Influence of Relativity, by George David Birkhoff. Six university lectures that give a clear basis for understanding a revolutionary theory. The Macmillan Company.

War Weather Vignettes, by Alexander McAdie. How weather influenced the world war—how blizzards and mists defied the finest of strategy. Illustrated. The Macmillan Company.

Surveying for Everyone, by A. Francon Williams. How to measure and map land. Simple instructions for lay readers as well as students. The Sheldon Press.

Fundamental Concepts of Physics, by Paul R. Heyl, Ph.D. A discussion of the changing ideas of physics from the 18th century. Williams & Wilkins Company.

A History of Engineering, by A. P. M. Fleming and H. J. Brocklehurst. An illuminating story of the development of engineering through the ages. Illustrated. A. & C. Black, Ltd.

Aeronautical Meteorology, by Willis Ray Gregg. A handbook acquainting the reader with the behavior of the upper air. Contains detailed information needed by the airman. The Ronald Press Company.

Science, Religion and Reality. Distinguished men of English universities throw new light on the question, whether science is an enemy to religion. The Macmillan Company.

Outdoor Boy Craftsmen, by A. Neely Hall. Ideas for the boy who likes to make things. Lothrop, Lee & Shepard Co.

Play the HAWAIIAN GUITAR
Just as the Natives Do

FREE when you enroll
\$15 HAWAIIAN GUITAR and Case

Only 4 Motions used in playing this fascinating instrument. Our native Hawaiian instructors teach you to master them quickly. Pictures show how. Everything explained clearly.

Play in Half Hour
After you get the four easy motions you play harmonious chords with very little practice. No previous musical knowledge necessary.

Easy Lessons
Even if you don't know one note from another, the 52 printed lessons and the clear pictures make it easy to learn quickly. Pay as you play.

Free Guitar
and Outfit in Genuine Seal Grain Fabrikoid Case as soon as you enroll. Nothing to buy—everything furnished. No delay.

Write at Once
You'll never be lonesome with this beautiful Hawaiian Guitar. Write for Special Offer and easy terms. A postcard will do. ACT!

FIRST HAWAIIAN CONSERVATORY OF MUSIC, Inc.
9th Floor, Woolworth Bldg., Dept. 146 New York, N. Y.
Approved as a Correspondence School Under the Laws of the State of New York

A FILE **Stop Forgetting** **A FILE**

Make Your Mind an Index from which you select facts, figures, names, facts. Develop concentration, self-control; overcome bashfulness, forgetfulness. Write today for FREE memory and concentration test and illustrated booklet, "How to Remember."

PROF. HENRY DICKSON
Dept. 929, Evanston, Ill.

"STAMMERING"
Its Cause and Cure

You can be quickly cured if you stammer. Send 10 cents, coin or stamps, for 288 page cloth bound book on Stammering and Stuttering. It tells how I cured myself after Stammering and Stuttering for 20 years.

BENJAMIN N. BOGUE
7527 Bogue Bldg., 1147 N. Ill. St. Indianapolis, Ind.

What do You have to say when you are with interesting people?

Can you hold up your end in a general conversation—or are you tongue-tied when with people?

AFTER the weather has been discussed and exhausted it is only the well informed man—the good talker—who can hold the attention and interest of his friends.

Everybody envies a good talker. You know from experience the big advantage the man or woman has who is an easy, fluent talker. In every-day life men and women who have this personal advantage are popular—sought after. And in their trade, business or profession they are the ones that get to the top.

The valuable ability of being able to converse smoothly, naturally and with full confidence is based on having at your command a fund of knowledge that will be of interest to those you are talking to.



What Worth-While People Are Talking About

Today the most entertaining, the most fascinating subjects are those that deal with applied science—radio... aeronautics... the automobile; new discoveries in health... evolution... electricity.

These are the subjects that intelligent people are thinking and talking about. These are the things the worth-while men and women of your town or city are discussing.

To make it possible for you and the other thousands of men and women who feel the urge to keep up with the important things scientists have definitely established and the new discoveries that they are making we offer you THE POCKET GUIDE TO SCIENCE and 14 issues of POPULAR SCIENCE MONTHLY—all for less than 12 issues of POPULAR SCIENCE MONTHLY would cost you on the newsstand.

THE POCKET GUIDE TO SCIENCE is written in simple question-and-answer form that educators have found to be the most effective way for telling the known facts on a specific subject. In this one brilliant book of 284 pages

have been condensed all that you probably will ever want to know about science.

You are assured of the accuracy of the answers in THE POCKET GUIDE TO SCIENCE, as it was edited by Dr. E. E. Free, who has a remarkable genius for condensing the known facts about the world we live in into short, easily remembered paragraphs.

SPECIAL OFFER

THE POCKET GUIDE TO SCIENCE is not for sale. It is included, without any extra charge, with a 14 months' subscription to POPULAR SCIENCE MONTHLY.

POPULAR SCIENCE MONTHLY "carries on" from where THE POCKET GUIDE TO SCIENCE leaves off. THE POCKET GUIDE gives you all that the scientists have discovered up to right now—POPULAR SCIENCE MONTHLY will give you all the important, interesting and new discoveries of science for the next 14 months.

It takes over 300 articles and pictures every month to tell the readers of POPULAR SCIENCE MONTHLY all that has happened in the scientific, radio, mechanical and automotive fields.

Your Name in Gold on this Wonderful Book

THE POCKET GUIDE TO SCIENCE is bound in beautiful flexible fabrikoid. We will stamp your name in 22-carat gold on the cover of THE POCKET GUIDE at no extra cost to you if you use the coupon below immediately.

We extend to you the Special Offer of a 14 months' subscription to POPULAR SCIENCE

MONTHLY (regular price by the month would be \$3.50) with THE POCKET GUIDE TO SCIENCE—all for \$2.95, plus the few cents' postage.

If you are already a subscriber to POPULAR SCIENCE MONTHLY, we will extend your subscription 14 months if you accept this offer.

SEND NO MONEY

Send no money, just the coupon. If within 10 days after you receive the book and magazine you decide that you are not satisfied in every particular, you may return them, and your entire payment will be refunded promptly and without question. Could any offer be fairer?

Popular Science Monthly
250 Fourth Avenue, New York

I accept your offer of THE POCKET GUIDE TO SCIENCE and a 14 months' subscription to POPULAR SCIENCE MONTHLY. I will pay the postman \$2.95, plus the few cents' postage when he delivers the POCKET GUIDE and the first issue of POPULAR SCIENCE MONTHLY.

If the book and magazine are not fully satisfactory to me, I will return them within 10 days and you are to promptly refund my full payment. Please stamp my name in gold on the POCKET GUIDE TO SCIENCE.

Name

Address

City..... State.....



The only man who could talk to the Superintendent

"SOON after I began studying," a student wrote to us the other day, "we had a change in management at our plant. I certainly was glad then that I had decided to study in my spare time. For, thanks to my I. C. S. course, I was the only man in the organization who could talk to the Superintendent in his own language. As a result, I was promoted over men who had been here from ten to twenty years. My salary has been increased 90 per cent in the last ten months."

THAT'S a true story of what just one I. C. S. student has done. There are thousands of others. Every mail brings letters from men and women telling of promotions and increases in salary due directly to spare-time study.

One hour a day, spent with the I. C. S. in the quiet of your own home, will prepare you for success in the work you like best. Yes, it will! Put it up to us to prove it.

Mail this Coupon To-day

INTERNATIONAL CORRESPONDENCE SCHOOLS
Box 7684-D, Scranton, Penna.

Oldest and largest correspondence schools in the world
Without cost, please tell me how I can qualify for the position or in the subject before which I have marked an X:

- BUSINESS TRAINING COURSES**
- | | |
|--|---|
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish <input type="checkbox"/> French | <input type="checkbox"/> Illustrating |
- TECHNICAL AND INDUSTRIAL COURSES**
- | | |
|---|--|
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineer | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Gas Engine Operating | <input type="checkbox"/> Chemistry <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Automobile Work |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Metallurgy <input type="checkbox"/> Mining | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Steam Engineering <input type="checkbox"/> Radio | <input type="checkbox"/> Mathematics |

Name..... 6-26-25
Street.....
Address.....
City..... State.....

Occupation.....
If you reside in Canada, send this coupon to the International Correspondence Schools Canadian Limited, Montreal

ELECTRICITY

My first job after leaving school took 2 hours and I received \$45.00 for the inspection. I worked up to over \$100.00 a month and expect to clear \$10,000 the first year.
Paul A. Carson.

You learn by doing

Actual experience in our practical shops and laboratories. You will find a place at S. O. K. and a course to meet your needs. 3 months D.C. and A.C. armature winding, auto electricity or radio courses fit you for fast advancement. Learn practical electricity in 4 months; junior electrical engineering, commercial electrical engineering or electro-technician in 12 months; Electrical Engineering 3 years. Step in the line of advancement. Send for FREE ILLUSTRATED CATALOG TODAY.

SCHOOL of ENGINEERING of Milwaukee

Dept. FS-326—415 Marshall St., Milwaukee, Wis.

Mistakes I Made When I Built My House

(Continued from page 30)

error. They are not heavy if a bit awkward to handle, and save time in placing and removing. Only one has been slightly damaged in half a dozen years.

All amateur builders are subject to attacks of perverted ingenuity. We have bright ideas and we execute too many of them. "It can be done!" is our motto, regardless of natural law and commercial practice. Often we win. At least we get our money's worth in experience, and we regard our rankest failures with the indulgence of a parent toward his clever but wayward offspring. This is how I think of several doodads in and about our home—the automatic cistern cut-off; a device to free poultry in the morning without trudging to the henhouse; and those concrete ramps in the basement which could have been avoided by cutting a bit of foundation wall.

Once I had a trapdoor from the sleeping porch to a garden tool compartment below. What was the object? Either it was a notion borrowed from a mystery play or there was a dim thought of convenience in winter, having snug access to this remote outpost of the dwelling. That trapdoor is now nailed down, for I saw its advantage outweighed by the chance of a broken neck.

YES, we amateurs love conveniences, especially doors that are numerous. We don't realize that surplus openings are a nuisance, add expense and, when leading outdoors, admit insects in summer and draughts in winter. Bugs enter despite a screen door, at least when you go in and out, and the best weather-stripping is not equal to solid wall. Few outer doors mean less coal and more all-year comfort. In our manse the sleeping porch has no outer access, which makes it defective as a place to entertain company—it's plenty large for that—but we gain seclusion and freedom from skeeters.

When I added a garage to the house, the door-convenience delusion caused me to fancy a communicating portal of the self-closing type prescribed by the fire underwriters. It would have been costly and, I saw, hazardous; gas fumes could fill the basement and reach the furnace, regardless of the door's behavior. The door was moved, on paper, all around the garage. Finally, by good luck and reasoning, it was totally erased and substituted by the main entrance of the garage. Our car stable is so much the safer and also warmer in winter. The few extra steps around are never regretted.

A GENUINE convenience—that-might-have-been is a device for filling the ice chest from outside. Our chest in the basement sits high on concrete walls so we don't have to stoop to open it, and there is a trap drain to remove the waste water: two merits. But we are subject to the despotic pleasure of the iceman. In hot weather we hardly dare leave home. Back from a short motor ride in summer, we find at the door a tiny Kohinoor scintillant in a pool of water, all that remains of a young berg the iceman left.

(Continued on page 139)

ART

We Teach COMMERCIAL ART

Meyer Both Company, maintaining the most widely known Commercial Art Studios in the World, offers you a practical training based upon 25 years' success in producing over a quarter million drawings for leading advertisers. This attractive profession equally open to men and women. Home study instruction.

Get Facts Before You Enroll in Any School
Send 4c in stamps for illustrated book telling of the success of our students.

MEYER BOTH COMPANY
Dept. 35
Michigan Ave. at 20th St.
CHICAGO, ILL.

A Test Every Man Past 40 Should Make

Medical authorities agree that 65% of all men past middle age (many much younger) are afflicted with a disorder of the prostate gland. Aches in feet, legs and back, sciatic pains, are some of the signs—and now, a well known American scientist has written a remarkably interesting Free Book that tells of other symptoms and just what they mean. No longer should a man approaching or past the prime of life be content to regard these pains and conditions as inevitable signs of approaching age. Already more than 20,000 men have used the amazing method described in this book to restore their youthful health and vigor—and to restore the prostate gland to its proper functioning. Send immediately for this book. If you will mail your request to the Electro Thermal Company, 4055 Main Street, Steubenville, Ohio—the concern that is distributing this book for the author—it will be sent to you absolutely free, without obligation. Simply send name and address. But don't delay, for the edition of this book is limited. Western Office, Dept. 40-X, 711 Van Nuys Bldg., Los Angeles, Calif.

I Averaged \$20.77 profit PER DAY for 217 Days

Any MAN can sell them

says L. D. Payne, Frank DePries made over \$325 profit in one day. Sidel and Viles sold over \$25,000 in 2 years. G. Howard earned \$100 in one day. F. E. Mendenhall worked half time and made \$100 a week. W. E. Findlay ran up his commissions in a few months from \$100 to over \$500 per month. Every Home, Auto Owner, Store and Factory a Live Prospect—Keston, Howard, and others, never sold Fire Extinguishers before. Our special training course starts you on road to success first day. If now employed, we can show you how to make big money during spare time. No Experience Necessary. Get our new Sales Plan—find out how to make real money—write today!

THE FYR-FYTER CO., 1010 Fyr-Fyter Bldg., Dayton, O.

Learn Photography at HOME

Many earn \$3000 to \$10,000 a year. Prepare quickly during spare time. Also earn while you learn. New easy method. Nothing else like it. Send at once for free book, "Opportunities in Modern Photography" and full particulars. Special offer open now.

INTERNATIONAL STUDIOS, Inc.
Dept., 1363 3601 Michigan Ave., Chicago, U. S. A.

A SERVICE FOR YOU

In Buying Radio and Tool Equipment

For list of tested and approved products write to the Popular Science Institute of Standards. See Page 6.

Mistakes I Made When I Built My House

(Continued from page 138)

We pay by the pound and receive by the carat. It takes the bloom off the blithest excursion. When the house was being built, I could easily have incorporated an outside filler for the ice chest. It will be a tedious and expensive job to do that now.

MOST everybody fastens things to masonry walls with wooden plugs pounded into drilled holes. I did that with some fruit shelves in our cold storage compartment. One night the dried-out plugs let go—it was during the war and we thought the enemy had dropped an air bomb on us—crashing 150 glass jars of tomatoes and fruit on the concrete floor. Not a jar survived, and the floor looked like a slaughterhouse. There was enough broken glass to rat-proof every chicken house in our community. After this event, I built new shelves of white pine boards supported by 1 1/4 by 3/8 inch steel straps, each bolted to the massive floor joists above; with 2 by 4 inch bolted crosspieces, and all shelving fastened to frames with long screws. As a test of strength, my neighbor helper and I lay at full length on the new shelves, and then we demonstrated rigidity by pulling and pushing the frame. Instead of wooden plugs in masonry walls (except for very unimportant jobs) use expansion bolts or pour lead or cement in place. For an extra heavy support, as needed by a steam radiator for example, I put long bolts completely through a masonry wall with washers and nuts duly attached.

The amateur builder is cheered when he finds that certain faults entail only a mild penalty or that makeshifts have served a fair purpose. Such was the case with my original plumbing system. It was sketchy, queer, but never disastrous. When the time came to have real plumbing, the mechanic and I agreed to let the old waste line of cement-jointed tile rest in peace beneath the cement floor of the basement. It had served. Why spend time and energy in ripping up a floor that was adamant? We just swung the new iron waste line overhead, attaching it at intervals to the floor beams. This open-work plumbing conforms to the latest ideals of the craft; it is always subject to inspection and correction, while the owner likes to take visitors downstairs and show them the cast iron inscription in bas relief, "Avg. wt. 12 lbs. per ft."

FRRIEND Wife was doubtless right as to closets. I won't start a debate on this subject, which is an eternal moot point between the sexes. Have to admit that we fixed up an extra curtain closet afterward. My advice to amateur builders is, let the wife draw the closets first, then build your house around them.

The dining alcove had barely been invented at the time when we built. Otherwise we might have one instead of a dining-room that is used once a day and is theoretically an expensive luxury because of overhead. Think how the space we squander on a dining-room could be used to ennoble the living-room, expand the

(Continued on page 140)



Sudden New Demand for Daring Young Men!

Aviation in America is on the threshold of an amazing new development. For in the past few months gigantic commercial air lines have been established. The biggest capital and business forces in the world are behind this enterprise. Even in the beginning, thousands of young men are needed. For those who can qualify there will be highly paid jobs which will lead quickly and surely to advancement and success.

Big Opportunities Await the Trained Man

Look over the fields of work which are open to the young man today. You will find that Aviation is the ONE FIELD that is not overcrowded—the ONE FIELD in which there is plenty of room at the top. Think of it! Only 21 years ago Orville and Wilbur Wright made the world's first airplane flight. Now airplanes fly around the world. Yes, Aviation offers the same wonderful opportunities today that the automobile and motion picture industries did 15 and 20 years ago. Men who got in on the ground floor of those industries made fortunes before others woke up.

Easy to Become an Aviation Expert—\$50 to \$100 A Week

You can qualify now quickly for one of these exciting highly paid jobs through a new, sure, easy method of training. The study of Aviation is almost as interesting as the work itself. Every lesson is fascinating and packed full of interest. That's why Aviation is so easy to learn—you don't force your-

self to study. Only one hour of spare time a day will give you the basic training in an amazingly short time.

One student, S. F. McNaughton, Chicago, says: "Your lessons are like a romance, and what is more, after one reading, the student gets a thorough understanding. One never tires of reading them." James Powers, Pa., another student, says, "I am indeed surprised that such a valuable course can be had from such practical men for so little cost."

Men who have had actual experience in Aviation give you personal attention and guide you carefully through your training. They select the lessons, lectures, blue prints and bulletins. They tell you the things that are essential to your success. Every lesson is easy to read and quickly understood.

Big Book On Aviation FREE

Send coupon below for New Free Book just out, "Opportunities in the Airplane Industry." It is interesting and instructive and will show you many things about Aviation which you never knew before. Only a limited number offered—GET YOURS before the edition is exhausted.

AMERICAN SCHOOL OF AVIATION
3601 Michigan Ave., Dept. 1363, Chicago, Ill.

American School of Aviation	
3601 Michigan Ave., Dept. 1363, Chicago, Ill.	
Without any obligation, send me your Free Book, "Opportunities in the Airplane Industry," also information about your Course in Practical Aeronautics.	
Name.....	
Address.....	
City.....	State.....

500 QUARTS of Fire Gas from One Quart of Liquid

A new kind of gun—a fire gun—amazes everyone who sees it. For when a little valve is released 500 quarts of fire-destroying gas is produced from one quart of liquid. You can actually stand 25 or 30 feet away from a fire and by directing this stream of liquid at the base of the fire it quickly smothers the flames with its blanket of gas.



No Pumping

This new fire gun requires no pump like old-fashioned fire extinguishers. Does not jam or get out of order in the emergency. All you do is to turn a valve and hold the gun steady. You can hit a spot no bigger than a quarter, quite different from the pump gun that is bound to weave and splatter with every stroke.

Harmless, Stainless Liquid

Absolutely harmless to human beings. You can turn its spray directly on furniture, rugs, draperies, clothing and furnishings without even leaving a stain. Think what a great thing this wonderful invention makes for homes, offices, factories, schools and all other buildings. An instant protection against fire—one that is absolutely harmless and can be used by a child—one that puts out every kind of fire including celluloid, gasoline and kerosene.

AGENT MAKES \$131 IN ONE DAY

Automobiles Furnished Producers

The inventor of this wonderful gun wants salesmen, agents and spare time workers in every part of the nation to demonstrate it and is willing to pay them well. Already thousands of these guns have been sold and other men are making \$200 a week in full time and \$50 to \$100 a week in spare time.

Besides giving you free territory and free selling outfit, the inventor of this gun will furnish to producers free automobiles so that they can cover a bigger territory and make more money.

FREE Selling Outfit Offer

Do not hesitate a day. This wonderful invention is doubling and tripling the earnings of other men. La Barr actually made \$131 in one day. Clement made \$67.70 in one day. McPhail made \$1,140.10 in four months. Even if you can only work in spare time here is a wonderful opportunity to make \$5, \$10 or \$20 a day extra. Simply mail coupon below and you will get full details of this amazing new product and our offer to representatives. Get the coupon in the first mail.

WELDON MANUFACTURING CO.
DEPT. 6-C GRAND RAPIDS, MICH.

WELDON MANUFACTURING CO.
Dept. 6-C, Grand Rapids, Mich.
Send me at once full details of your amazing new fire gun and how I can get your free selling outfit and free territory. I am not obligated.
Name.....
Address.....
City.....State.....

Mistakes I Made When I Built My House

(Continued from page 139)

bath, create a sewing-room or den, and make ample—er—closets or anything. Maybe yes and maybe not. Once in a time a dining-room is handy. Perhaps the domicile of the future will have movable partitions so as to telescope a dining-room into an alcove and vice versa.

The amateur is prone to wed the mediocre to the superb: a poor roof and hardwood floors, a fine entrance and a dubious heating system. He saves on essentials and is wasteful on details. The old rule demands, first, a good foundation and a good roof, to which might be added proper outside walls. Any shack, however humble, deserves certain seeming luxuries, such as copper window screens and copper gutters and leaders for the roof; regular plumbing and an adequate heating plant. Such luxuries are cheap in the long run.

I HAVE quit the boast that our house is burglar-proof. The claim was riddled a while ago by a nine-year-old lad who was staying with us. During our absence, the youngster swarmed up the side of the sleeping porch, opened a door, entered the kitchen and coolly burgled a cookie jar. Thus a child wrecked a strong man's illusions. We are not burglar-proof.

Our garage is my pet. In it I have realized almost all my thwarted ambitions to create a perfect dwelling. It is solid and snug, equipped with all necessary features, so fireproof that it needs no insurance. The underwriters absolve the garage of being a hazard to the house, although the two structures are separated only by a party wall. The garage has concrete block walls and a reinforced concrete roof that is five inches thick and eleven feet in span. The roof is the main thing. It is a fine example of faith and guesswork. That slab of artificial stone weighs several tons and has no visible means of support. Not a crack, not a leak in four years!

THE garage has electric light, steam heat and water, put through the basement party wall. A gas pump connects with a buried tank. The concrete floor slopes to a centre drain.

The garage door is double-layered cypress boards, tongue-and-groove, run vertically outside and horizontally inside, fastened together with screws. No braces required; all hardware inside. It is in three triple-hinged leaves, hangs on a track above and rolls easily to lie flat against an inside wall. Such a door is never snow-blocked nor wind-banged. One of the hinged leaves gives ordinary entrance. It is a door that, with a trifle of outward ornament, would befit any castle in Spain.

When depressed by flaws in the house, I go to the garage and admire it and myself. At times the thought occurs, Why not move out of an imperfect house and live in our faultless garage? My wife says it would save housework. We would have light, heat, water and open plumbing. What more does anyone want in a home?

Every Morning

A Smooth, Clean Shave In 30 Seconds

Ask a thousand men what the morning's most disagreeable task is and a thousand will answer, "Shaving!" And no wonder, when you consider how primitive modern shaving is. You scrape, pull and hack for several minutes with a blade that was once sharp—the result—a sore, itching, irritated face, a ruffled temper, a loss of time. You can't imagine how pleasant your morning shave can be until you try the new



Electric Safety Razor. Only 30 seconds for the smoothest, easiest shave you have ever had. Its electrically operated blade, vibrating 7200 times a minute, is the secret of this new, scientific method of perfect shaving. Many women, too, as well as men, have discovered the satisfaction of using the Vibro-Shave. Why deny yourself the pleasure of a perfect shave every morning? Use the Vibro-Shave Electric Safety Razor once and you will never want to be without it. Send us \$10.00 today, and we will send you the complete outfit, including scalp and massage attachment, five blades, cord and plug, attractively boxed. Your money refunded without question within ten days if you are not satisfied.

Vibro-Shave. Makes last three times as long as ordinary blades.

Razor Products Corporation
1440 Broadway New York



FREE Book on Deafness



Write today for 168 page FREE book giving full particulars and testimonials from hundreds of grateful users whose hearing has been restored by use of our "little wireless phones for the ears."

Wilson Common-Sense Ear Drums
require no medicine but effectively replace what is lacking or defective in the natural ear drums. They are simple devices, which the wearer easily fits into the ears where they are invisible. Soft, safe and comfortable.
WILSON EAR DRUM CO., Incorporated
493 Todd Building LOUISVILLE, KY.

HAIR GROWS!



When our Vacuum Cap is used a few minutes daily. Sent on 60 days FREE trial at our expense. Stops falling hair and dandruff. Science combined with common sense. No drugs or electricity. A postal brings illustrated booklet.

Modern Vacuum Cap Co.
400 Barclay, Denver, Colo.

HAVE YOU AN INVENTION?

If so the WORLD PROGRESS will send you upon request sample copy Free containing Suggestions to Inventors as to Inventions Needed. We invite manufacturers to address us regarding inventions they want. Subscription for one year 60 cents.
WORLD PROGRESS PUB. CO., INC.
Room 202 Victor Bldg. Washington, D. C.

I Need Branch Managers



LIGHTNING—

Wonderful New Electrolyte

charges discharged batteries instantly. Eliminates old sulphuric acid method entirely. Dissolves sulphation. World has waited half a century for this invention. One gallon retails \$10.00, free to agents.

LIGHTNING BATTERY CO., ST. PAUL, MINN.

LATEST WHOLESALE RADIO CATALOG

FREE Simply send name TO-DAY for big 64-page book explaining liberal proposition paying agents \$60 to \$100 a week, and how to get the latest radio goods at Wholesale.

Live dealers and agents wanted
STANDARD RADIO CO., 1404 Walnut St., Kansas City, Mo.

They Fly Their Own Planes

(Continued from page 19)

For instance, S. H. Curlee, president of a clothing company in St. Louis, decided a few months ago to establish a flying department in his organization. Roscoe Turner, a young commercial flier from Corinth, Miss., was placed in charge of experimental flying and is preparing to teach the company's salesmen how to pilot machines.

Another business executive who has found that flying pays is Ross W. Judson, president of Continental Motors. Only a few weeks ago he purchased one of the new Fokker three-engined, 10-passenger planes and announced that he and other executives of the company would use it on trips between the plants in Detroit and Muskegon, Mich. And everyone knows, of course, of Henry Ford's success in establishing a fleet of his planes in a passenger and freight transport system.

IN THE professional field we find such men as Dr. Herman J. Neubauer, a physician of Hinkley, Ill. Not long ago he bought a two-seater biplane, hired a pilot, and now makes his rural calls by air.

Even the sportsman is taking to the air as Earl Sande, the great American jockey, will tell you. Not long ago, Sande climbed into the saddle of a Curtiss Oriole at Garden City and went for his first air ride. When he came down, he announced his intention of using an airplane instead of an automobile hereafter, to make his trips between racetracks in Maryland, Kentucky, and New York.

James Otis, a wealthy importer and sportsman of San Francisco, owns half-a-dozen planes, employs expert pilots and takes his recreation on airplane hunting trips into northern California.

There is another side of the story, however—one not so encouraging to those of us who have dreamed of flying some day from our roof tops or back yards—as I soon learned when I visited the Curtiss Field, Long Island. There I talked with C. S. Jones—"Casey," as he is popularly known to fliers, general manager of the Curtiss Flying Service, Inc.

"I don't like to be discouraging," said he, "but it is my opinion that airplanes will not compete with the pleasure automobile. Rather, the airplane is the competitor of the railroad train and the motor truck. Unlike automobiles, airplanes are restricted by the necessity for flying-fields and well-equipped service stations.

AT THE present time practically all the planes we sell are purchased for commercial purposes, for passenger and express service, for air mail, and for aerial photography. Private individuals who purchase machines are in the main young men who come to our aviation school. Rather than hire machines, they buy their own 'Jennies' for a thousand dollars or so and use them to learn how to fly. They keep them in our hangars, and usually they fly them here until the machines are worn out.

"Last year, about 50 of these boys bought their own planes. Some seek careers as commercial pilots; others just the sport of flying; others become Gypsy

(Continued on page 142)

FREE!



These Instruments FREE of Extra Cost

All instruments shown here and others—SIX BIG OUTFITS—sent to all our students free of extra cost under short-time special offer. **Clip coupon now**—find out all about this big unequalled offer while you still have time to take advantage of it. Our training is intensely practical—these instruments help you learn to do the practical work. Receiving sets, from simplest kind to thousand-mile receiver. Many other big features.



J. E. SMITH,
President

My Radio Training is The Famous "Course That Pays For Itself"

Spare time earnings are easy in Radio when you know it the way we teach you. Increase your income almost from the start of your course thru practical knowledge we give you. We show you how to hold the job, then our big Free Employment Department helps you get one. Free Book "Rich Rewards in Radio" tells how.

Howard B. Luce of Friedens, Pa., made \$320 in 7 weeks during his spare time. D. H. Suitt of Newport, Ark., writes "While taking the course I earned in spare time work approximately \$900." Earl Wright of Omaha reports making \$400 in a short time while taking his course—working at Radio in his spare time only! Sylvester Senso, 207 Elm Street, Kaukauna, Wis., made \$500.

And when your training is completed you're ready to step into a real big Radio job like C. C. Gielow, Chief Operator of the Great Lakes Radio Telegraph Company; E. W. Novy, Chief Operator of Station WRNY; Edward Stanko, Chief Operator of Station WGR; and hundreds of other N. R. I. Trained men. The National Radio Institute, Originator of Radio Home-Study Training, established 1914, today offers you the same opportunity these men had, under a bond that guarantees you full satisfaction or money refunded. It's your big chance to get into Radio—mail coupon for FREE Book and proof!

"MEN! Here's the 'dope' you've been looking for"

How TO GET INTO THE RADIO BUSINESS"

J.E.S.

\$50 to \$250 a Week in Work That is Almost Romance

If you're earning a penny less than \$50 a week, clip coupon now for FREE BOOK! New book, profusely illustrated, tells all about the Radio Profession, thousands of openings—in work that is almost romance! YOU can learn quickly and easily at home, through our tested, improved methods, to take advantage of these great opportunities. Why go along at \$25 or \$35 or \$45 a week, when you can pleasantly and in a short time learn to be a Radio Expert, capable of holding the big jobs—paying \$50 to \$250 a week?

Clip Coupon For Free Book

Don't envy the other fellow who's pulling down the big cash! Our proven home-study training methods make it possible for you, too, to get ready for a better job, to earn enough money so you can enjoy all the good things of life. Most amazing book ever written on Radio tells how—thousands of interesting facts about this great field, and how we can prepare you, quickly and easily in your spare time at home, to step into a big-pay Radio job. You can do what thousands of others have done through our training. **GET THIS NEW FREE BOOK. SEND COUPON TO-DAY.**

NATIONAL RADIO INSTITUTE

Dept. CT-9 Washington, D. C.

NOW!
Special Short-time Offer
6 BIG OUTFITS

Radio Needs Trained Men

Dept. CT-9
National
Radio Institute
Washington, D. C.

Dear Mr. Smith:
Without obligating me in any way, send me your big FREE BOOK, "Rich Rewards in Radio," and all information about your practical, home-study, Radio Course.

Name.....

Address.....

SEND THIS COUPON TODAY

INVENTORS PROTECT YOUR IDEAS

Before disclosing your invention send for our Evidence of Invention Blank. This should be signed and witnessed and returned to us with a model or sketch and a description of your invention for our Inspection and Instructions which are free.

Also send for

Our guide book "How to Get Your Patent" which is sent free upon request. This book includes full instructions regarding U. S. Patents, Trade Marks, our Terms, Methods, etc.



Terms
Reasonable
Best
References

RANDOLPH & CO.
Dept. 130, Washington, D. C.

WRITE TODAY

RANDOLPH & COMPANY,
Washington, D. C. Dept. 130.

Please send me **FREE OF CHARGE** your Evidence of Invention blank and your guide "How to Get Your Patent."

Name.....

Street.....

City..... State.....



Electricity at your finger ends

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books are pocket size; flexible covers. Order a set to-day to look over.

HAWKINS GUIDES

3500 PAGES \$1 A VOLUME
4700 PICTURES \$1 A MONTH

These books tell you all about —

Magnetism — Induction — Experiments — Dynamos — Electric Machinery — Motors — Armatures — Armature Windings — Installing of Dynamos — Electrical Instrument Testing — Practical Management of Dynamos and Motors — Distribution Systems — Wiring — Wiring Diagrams — Sign Flashers — Storage Batteries — Principles of Alternating Currents and Alternators — Alternating Current Motors — Transformers — Converters — Rectifiers — Alternating Current Systems — Circuit Breakers — Measuring Instruments — Switch Boards — Wiring — Power Stations — Installing — Telephone — Telegraph — Wireless — Bells — Lighting — Railways. Also many Modern Practical Applications of Electricity and Ready Reference Index.

SHIPPED TO YOU FREE

Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send Coupon now—today—and get this great help library and see if it is not worth \$100 to you—pay \$1.00 a month for ten months or return it.

SEND NO MONEY

THEO. AUDEL & CO.
65 W. 23rd St., N. Y.

Please submit for examination Hawkins Electrical Guides (Price \$1 each). Ship at once, prepaid, the 10 numbers. If satisfactory, I agree to send you \$1 within seven days and to further mail you \$1 each month until paid.

Name.....
Address.....
Occupation.....
Employed by.....

3T34

LAW Personal Instruction
By Mail Be a lawyer or law trained business man. Qualify to earn \$2,500.00 to \$15,000.00 a year. University methods. TUITION LOW. EASY TERMS. Text books furnished. Practical and authoritative non-resident course. Endorsed by bench and bar. Prepares for bar or business. Over 60,000 students. PERSONAL INSTRUCTION. Guarantee to coach free any graduate failing to pass bar exams. SPECIAL REDUCED TUITION OFFER now in force. Write today for particulars and book on law FREE.

AMERICAN CORRESPONDENCE SCHOOL OF LAW
Dept. 1362 3601 Michigan Avenue, CHICAGO

It's Great to Be Strong



You don't know what it is to live until you are strong and vigorous. Until you have rolling, iron-like muscles, broad shoulders, freely expanding chest and a punch that is feared by your fellowmen—you are not 100 per cent MAN. To be admired you must be physically fit. To command respect you must have vigorous health and manly strength. You must have abundant energy, pep and personality. You won't get far in this world without these qualifications—the good things of life are not for weaklings.

Mere development of external muscles on arms, legs and body does not bring health and permanent strength. Your internal muscles must have first consideration, for these muscles must be made the foundation of all health and strength—and here is where my course of instruction differs from all others you ever heard of.

STRONGFORTISM Has Helped Thousands

If you are ailing, weak, incompetent and well-nigh hopeless, you should take heart from the fact that so many others like you, or worse, have taken up STRONGFORTISM and been rejuvenated, exhilarated, and made upstanding men again. Do not suffer weakness another day. Don't stand for constipation, catarrh, indigestion, nervousness.

I CAN HELP YOU All that I ask is that you write stating briefly and clearly what troubles you. Send for my book of confidential information revealing how I can help you.

LIONEL STRONGFORT

Physical and Health Specialist for over 25 Years
Dept. 126 Newark, N. J.
Mr. Lionel Strongfort, Dept. 126, Newark, N. J.
Please send me your wonder book "Promotion and Conservation of Health, Strength and Mental Energy." I enclose 1 dime (10¢) to help cover postage, wrapping, etc.
Name.....
Age..... Occupation.....
Address.....

They Fly Their Own Planes

(Continued from page 141)

Fliers, wandering from place to place and making trips for hire; and still others learn to fly because they see a big future for aviation."

Yet, despite the limitations mentioned by "Casey" Jones, the day of air motoring for everybody may not be so far distant. For one thing, the number of convenient flying-fields is increasing so rapidly that it will not be more than a few years at the most before practically every city and town of importance will have its own airport.

THE other day, in the office of the Aeronautical Chamber of Commerce, I learned, for example, that questionnaires had been sent to some 400 American cities and towns asking them what they were doing in the way of developing public flying-fields and service stations for airplanes, and offering co-operation in such development. And in every reply that had been received, it was stated that a public landing field already had been established or was being planned.

The Ford Airport at Dearborn, Mich., and the recently established airport for both land and sea planes at East Boston, Mass., covering 852,000 square feet of land, are two outstanding examples. At the latter field, the Boston Airport Corporation right now is planning not only to provide cheap and safe aerial taxi service for the public, but also service and repair stations for individual owners of planes.

There is encouragement to be seen also in the new machines—planes that are being designed more and more to meet the needs of the average man.

In this connection a significant development is the light, economical baby-plane which can be housed in and flown from exceedingly limited space. In England, there have been produced midget planes measuring only 10 feet across, capable of being housed in an ordinary automobile garage, and costing only about \$1,000.

But an even more significant promise of giving us our own planes to fly—at least it seemed so to me—was exhibited by "Casey" Jones, the skeptic. He led me across the Curtiss Field, unlocked the door of a large hangar, and showed me a corner of the big shed where rested a magnificent little three-seater—the "Lark," latest of Curtiss creations.

In appearance, this little ship looked much like any other plane. But in one great point it was different: it was built with interchangeable parts. In other words, its upper and lower wings on both sides were all exactly alike, the same in design and dimensions. Any one of the wings could be substituted in place of any other. The same was true of its ailerons and its elevators. The purpose was obvious—standardized quantity production; lower cost; cheaper maintenance.

It was Henry Ford who said at the conclusion of the successful Ford reliability tour last fall:

"We'll put all the people into the air whenever they want to fly. Aviation is bigger in possibilities than anything else in the world. In a motor car, you can go wherever land exists; in an airplane, you can go wherever man can breathe."

MY PATENT
LAW OFFICESJUST ACROSS
STREET FROM
U.S. PAT. OFF.

PATENTS

INVENTORS
Write for these
FREE BOOKS!



At the left is a view of my drafting and specification offices where a large staff of experienced experts are in my constant employ. All drawings and specifications are prepared under my personal supervision.

PROTECT YOUR IDEAS

Take the First Step Today—ACTION COUNTS

If you have a useful, practical, novel idea for any new article or for an improvement on an old one, you should communicate with a competent Registered Patent Attorney AT ONCE. Every year thousands of applications for patents are filed in the U. S. Patent Office. Frequently two or more applications are made for the same or substantially the same idea (even though the inventors may live in different sections of the country and be entirely unknown to one another). In such a case, the burden of proof rests upon the last application filed. Delays of even a few days in filing the application sometimes mean the loss of a patent. So lose no time. Get in touch with me at once by mailing the coupon below.

No Charge for Information on How to Proceed

The booklet shown here contains valuable information relating to patent procedure that every inventor should have. And with it I will also send you my "Record of Invention" form, on which you can sketch your idea and establish its date before a witness. Such evidence may later prove valuable to you. Simply mail the coupon and I will send you the booklet, and the "Record of Invention" form, together with detailed information on how to proceed and the costs involved. Do this NOW. No need to lose a minute's time. The coupon will bring you complete information entirely without charge or obligation.

Prompt—Careful Efficient Service

This large, experienced organization devotes its entire time and attention to patent and trademark cases. Our offices are directly across the street from the U. S. Patent Office. We understand the technicalities of patent law. We know the rules and requirements of the Patent Office. We can proceed in the quickest, safest and best ways in preparing an application for a patent covering your idea. Our success has been built on the strength of careful, efficient, satisfactory service to inventors and trademark owners located in every state in the Union.

Clarence A. O'Brien

Registered Patent Attorney

Member of Bar of: Supreme Court of the United States;
Court of Appeals, District of Columbia;
Supreme Court, District of Columbia;
United States Court of Claims

Practice confined exclusively to Patents, Trademarks,
and Copyrights

Strict Secrecy Pre- served—Write Me in Confidence

All communications, sketches, drawings, etc., are held in strictest confidence in strong, steel, fireproof files, which are accessible only to authorized members of my staff. Feel free to write me fully and frankly. Your case will have my personal attention. It is probable that I can help you. Highest references. But FIRST—clip the coupon and get my free book. Do THAT right now.



RECORD
—OF—
INVENTION
BLANK

TO WHOM IT
MAY CONCERN



Mail this Coupon NOW

CLARENCE A. O'BRIEN

Registered Patent Attorney,
8895 Security Savings & Commercial Bank Bldg.,
Washington, D. C.

Please send me your free book, "How to Obtain a Patent," and your "Record of Invention" form without any cost or obligation on my part.

Name

Address

(Important: Print or Write name clearly)

PATENTS

TRADE-MARKS
DESIGNS
FOREIGN PATENTS

MUNN & CO.

PATENT ATTORNEYS

Associated since 1846 with the Scientific American

683 WOOLWORTH BUILDING
New York City

1311 TOWER BUILDING
Chicago, Ill.

522 SCIENTIFIC AMERICAN BLDG.
Washington, D. C.

664 HOBART BUILDING
San Francisco, Cal.

519 VAN NUYS BUILDING
Los Angeles, Cal.

Books and Information on Patents
and Trade Marks By Request.
Associates in All Foreign Countries.

Can a Bald Man Grow Hair?

(Continued from page 22)

would no sooner think of applying soap and water to their scalps than of bathing in concentrated sulphuric acid.

Let the prosecution against dandruff account, if it can, for the fact that dandruff affects the whole scalp but alopecia carefully selects its acreage. Furthermore, the bald spots are quite symmetrical in their distribution and growth, and it is a well established tenet in medicine that when the evidences of disease are evenly distributed on the two sides of the body the cause of the trouble is almost surely systemic rather than local.

THE latest theory of baldness, and the one which seems quite consistent with demonstrable facts, ought to spread joy among the countless thousands of bald-headed men. In brief, this view holds that baldness is a normal attribute of manhood. Women seldom become bald. Only masculine men are permitted to develop the alopecic insignia of their virility.

Popular imagination has long recognized the association of early baldness with a high degree of masculinity. Many of the satyrs pictured on the Greek vases were young and bald. The time-worn joke about reserving the first row at burlesque shows for bald-headed men is not without its element of truth.

The nature of the glands of internal secretion needs but little elucidation in these days of public enlightenment. In brief, an internal secretion is one that does not pass out from the gland through a duct but escapes from the secreting cells directly into the blood. Because of the fact that the secreted substance permeates every part of the body through the medium of the blood, it has been aptly termed a "chemical messenger."

SUCH a chemical messenger is responsible for the development of the general characters which mark the differences between the sexes. In the male, the internal secretion results in the male type of figure, in the low-pitched voice, in the growth of a beard, and in the acquisition of masculine aggressiveness. Briefly, the new theory of baldness holds that the condition of baldness is not a disease but a normal male characteristic.

The number of fake cures for baldness on the market exceeds the census of millionaires in Florida. Their continued existence is accounted for by the law of supply and demand: The stork supplies a new bald-headed sucker every five minutes and the manufacturer of the alleged hair fertilizer demands his dividends proportionately.

On the face of them, the claims made by the promoters of these nostrums are as incredible as a ten-dollar deed to the Grand Central Station. No thinking man would take the bait; but the trouble is that few men think, and those who do don't think all the time. When hope enters by the doorway, reason flies out through the window; and when hair is promised to a bald man, he buys first and thinks last, if ever.

(Continued on page 146)

U.S. PATENTS



SEND FOR
THIS FORM

DON'T LOSE YOUR RIGHTS TO PATENT PROTECTION

Before disclosing your invention to anyone send for blank form "EVIDENCE OF CONCEPTION" to be signed and witnessed. A sample form together with printed instructions will show you just how to work up your evidence and establish the same before filing application for patent. As registered patent attorneys we represent hundreds of inventors all over the United States and Canada in the advancement of inventions. Our schedule of fees will be found reasonable. The form "Evidence of Conception," sample, instructions relating to obtaining of patents and schedule of fees sent upon request. Ask for them,—a post card will do.

PATENTS AND TRADE MARKS

LANCASTER & ALLWINE

Registered Patent Attorneys in U. S. and Canada

274 Ouray Bldg.
WASHINGTON, D. C.

Originators of form "Evidence of Conception."

PATENTS

To the Man With an Idea

I offer a most comprehensive, experienced, efficient service for his prompt, legal protection and the development of his proposition.

Send sketch, or model and description, for advice as to cost, search through prior United States patents, etc. Preliminary advice gladly furnished without charge.

My experience and familiarity with various arts, frequently enable me to accurately advise clients as to probable patentability before they go to any expense.

Booklet of valuable information and form for properly disclosing your idea, free on request. Write today.

RICHARD B. OWEN

Patent Lawyer

6 Owen Building, Washington, D. C.
41-D, Park Row New York City

**TRADE-MARKS
REGISTERED**

\$100 in Cash Prizes

See Page 4
front of book
for details

WANTED

RAILWAY POSTAL CLERKS—MAIL CARRIERS

\$1700 to \$3000 Year

TRAVEL—See Your Country

MEN—BOYS, 17 UP SHOULD MAIL COUPON
Steady Work. No Layoffs. Paid Vacations.



FRANKLIN INSTITUTE,
Dept. M-272, Rochester, N. Y.

Sirs: Send me without charge (1) Specimen Railway Postal Clerk Examination questions; (2) FREE book containing list of U. S. Government positions open to men and boys; (3) Free sample examination coaching.

Name.....

Address.....

PATENTS TRADE-MARKS AND COPYRIGHTS

OUR OFFER:

Your first step

Before disclosing an invention the inventor should write for our blank form "RECORD OF INVENTION." This should be signed, witnessed and returned to us together with model or sketch and description of the invention for INSPECTION and INSTRUCTIONS.

NO CHARGE FOR THE ABOVE INFORMATION

Our Four Books Mailed Free to Inventors

Our Illustrated Guide Book

HOW TO OBTAIN A PATENT

Contains full instructions regarding U. S. Patents. Our Methods, Terms, and 100 Mechanical Movements illustrated and described.

OUR TRADE-MARK BOOK

Shows value and necessity of Trade-Mark Protection. Information regarding Trade-Marks and unfair competition in trade.

OUR FOREIGN BOOK

We have Direct Agencies in Foreign Countries, and secure Foreign Patents in shortest time and at lowest cost.

Progress of Invention

Description of World's Most Pressing Problems by Leading Scientists and Inventors

ALL COMMUNICATIONS AND DATA STRICTLY CONFIDENTIAL
INTERFERENCE AND INFRINGEMENT SUITS PROSECUTED

IMPORTANT

TO MAKE YOUR CASE SPECIAL AND AVOID DELAY YOU SHOULD HAVE YOUR CASE MADE SPECIAL IN OUR OFFICE to secure protection, save correspondence and obtain early filing date in Patent Office. To secure special preparation of your case send \$25.00 on account with model or sketch and description of your invention.



Private Office, Victor J. Evans, with view of Patent Office Through Window

Highest References Prompt Attention Reasonable Terms
VICTOR J. EVANS & CO., Patent Attorneys

**FREE
COUPON**

Main Offices: 760-9th St., N. W., Washington, D. C.

Gentlemen: Please send me FREE OF CHARGE your books as described above.

Name

Address



New York Office
Suite 1007 Woolworth Bldg.



Philadelphia, Pa., Office
Suite 518-519 Liberty Bldg.



Washington, D. C., Office
Victor Bldg.



Chicago, Ill., Office
Suite 1114 Tacoma Bldg.



Pittsburgh, Pa., Office
Suite 514 Temple Bldg.



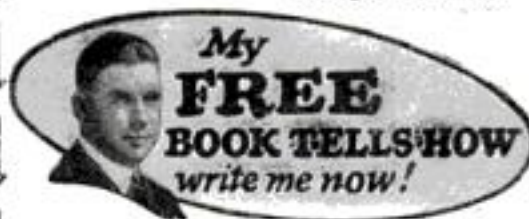
San Francisco, Cal., Office
Suite 1010 Hobart Bldg.

Only 8 Weeks For A Big Pay Job

In the auto, tractor
and electrical business

Get My
AMAZING
OFFER

George W. Smith, of
West Alexandria, O.,
did it—in 8 weeks.
Read this: "Dear Mac:
I am clearing more than
\$800 a month. I'll tell
the world McSweeney
training put me over."
Signed—
George W. Smith.



J. H. McSweeney, World's large operator
of Auto, Tractor and Electrical Training
Shops—Cincinnati, Chicago, Cleveland.

I'LL PAY YOUR RAIL-
ROAD FARE TO CIN-
CINNATI, CLEVELAND
or CHICAGO, and YOUR
BOARD FOR 8 WEEKS

My Special Offer includes your
railroad fare and board, but you
must act quickly. Men are
needed. Address my nearest
shops.

BIG FIRMS NEED TRAINED MEN

I get calls daily from successful
concerns for McSweeney trained
men. They know McSweeney men
are shop-trained, experts on autos,
tractors and motors. That's why
McSweeney men are in demand.

My
Training
Unusual

Here's the big
secret — sci-
entific tool-train-
ing. I train you
with tools, not
text books, on

modern equipment and in wonder-
ful shops.
Write at once for my remarkable
short time tuition offer.

McSWEENEY
Auto, Tractor and Electrical
TRAINING SHOPS

9th & Walnut
Cincinnati, O.
516 So. Laflin
Chicago, Ill.
1815 E. 24th St.
Cleveland, O.

SEND FOR
FREE BOOK

McSweeney Auto, Tractor and Elec-
trical Shops, Dept. 134. (Address
nearest shops) Cincinnati, O., Cleve-
land, O., Chicago, Ill.
Without obligation send me your Big
FREE Book on Autos, and Full De-
tails of your Special Short Time Offer.

Name.....
Address.....
City.....

3 BIG SHOPS
CINCINNATI
CLEVELAND-CHICAGO

Can a Bald Man Grow Hair?

(Continued from page 144)

The other day a really shrewd busi-
ness man told me that he could build
a house on what he had spent for "cures
for baldness." He informed me that he is
still ready to spend money to get his hair
back, and I prophesy that he never will
have trouble in finding someone who is
ready to exchange a marvelous hair
restorer for a slice of his income.

Most of the alleged cures for baldness
are constructed on the dandruff theory.
The idea seems to be that the hair sprouts
out of the skin like a bean seedling, that
cakes of dandruff keep this delicate struc-
ture from coming to the surface, and that
the removal of the obstructing layers of
dandruff is all that is necessary to allow
the little hairs to shoot up as luxuriantly
as a lawn after a heavy rainfall.

A recipient of one method of growing
hair once sought to squelch me by point-
ing to a new growth of downy hair on his
scalp. "That's what the treatment did
for me," he said proudly. But, six months
later when I asked him if the downy
growth of hair had gained strength, he
had nothing to say. Speech was unneces-
sary; his polished, hairless dome told the
whole story. The only thing the treat-
ment had grown was money in the seller's
bank account.

Solutions to Tests on Pages 26 and 27

1. Star Test

The method of scoring this test is to add
your time measured in seconds to the
number of errors you made, an error
being made each time your pencil
crosses one of the double lines that
make up the star. The average score
is 97. From 46 to 97 is superior; be-
tween 97 and 193 poor.

2. Concentration Test

The average person detects all errors
in two minutes. If you completed the
test in less time than this your power
of concentration is superior. If you
took more than two minutes you are
lacking in ability to concentrate.

3. Proverb Test

a=11, b=6, c=1, d=8, e=13, f=9,
g=2, h=7, i=10, j=5, k=4, l=12,
m=3. You should have completed
this test in the five minutes allowed.

4. Symbol Test


The average person can place the num-
bers correctly in the symbols in two
minutes. You can measure your adapt-
ability and your power of learning new
things by noting whether you com-
pleted the test in less or greater time
than this.

5. Letter-Number Test

This test can be completed by a person
of average intelligence in 144 seconds.

6. Number-Series Test

You should be able to complete this
test in not more than three minutes.



**LEARN
BY DOING**
Every phase of all
branches

ELECTRICITY
taught by
Actual Practice
In America's foremost and
oldest institution for trade
training

No Books Used
Individual Instruction
Start Any Day
Write for FREE 64-page catalog

**THE NEW YORK
ELECTRICAL SCHOOL**
40 West 17th St., New York City



**Your Choice
\$20.00
Musical
Instruments
FREE To Our
Students**


Your choice of a Violin, Tenor Banjo, Hawaiian Gul-
tar, Banjo, Cornet, Ukulele, Banjo Ukulele, Guitar,
Mandolin or Banjo Mandolin. You will be proud to
own any one of these instruments and you can have
one absolutely free. A few cents a day for lessons is
your only expense. Our system of teaching is so easy
that you can play several pieces by note with the first
four lessons. We guarantee success or no charge.
Instrument and lessons sent on one week's free
trial. Write for booklet today, no obligation.

CHICAGO CORRESPONDENCE SCHOOL OF MUSIC
Orchard and Willow Streets, Dept. 29, Chicago, Illinois

RUPTURE
Try this to be
rid of Rupture

Immediate and permanent relief and
comfort is assured to rupture sufferers
by the Schuiling Rupture Lock. It seals
in the opening. No elastic bands, cruel
springs or binding braces. Nothing to irri-
tate or chafe. No harness to wear. A
simple device. Relief, comfort and safety
result from its use. Write for free book
and trial offer.

SCHUILING RUPTURE INSTITUTE
181 Murphy Bldg. Indianapolis, Ind.



Learn Write
Begin Today—Write for my FREE BOOK. I can
make a good penman of you at home during spare
time. Write for my FREE BOOK, "How to Become
a Good Penman." It contains specimens and tells
how others mastered penmanship by the Tamblin
System. Your name will be elegantly written on a
card if you enclose stamp to pay postage. Write to-
day for book.

F. W. TAMBLIN, 437 Ridge Bldg., Kansas City, U.S.A.

STUDY AT HOME
Directed by
The University of Chicago
Courses in English, History, Chemistry, Business,
Mathematics, Education, Psychology, and 35 other
subjects command credit toward a Bachelor degree.
Begin any time. Address 25 Ellis Hall, University of
Chicago, Chicago, Ill.

Test Tubes Solve Crimes

(Continued from page 16)

found that one after another of his horses died for no apparent reason. The dealer naturally suspected his competitors who might have a grudge against him, and these simmered down to two; but they never came near his place.

"In desperation the dealer appealed to us, and a close watch was set on the barn. One day the guard noticed a boy about 16 years old hanging around the stable. He answered questions satisfactorily, and, when his pockets were searched, nothing was found in them beside the usual clutter, except an apple cut in two, one half in each hip pocket.

"Now, while it's not unusual to find an apple in a boy's pocket, it was queer to find it cut. The apple was sent to us, and we found that it contained yellow phosphorus, one of the deadliest poisons known. Examination showed the same poison in the stomachs of the dead horses. Confronted with this evidence, the boy confessed that one of the fruit dealer's competitors had hired him to feed the horses poisoned apples. It was a clear case, and we got a conviction.

"**WE HAD** a case not long ago," continued Mr. Kelley, telling of another poison incident, "of a couple who weren't getting along very well. Suddenly the husband developed a stingy streak. He began to ration his wife, especially on sugar. Each morning before going to work, he would set out a certain amount of sugar for the day, telling her that she had to be content with that ration.

"The wife began to feel ill, but the doctor could find nothing seriously wrong. He suspected indigestion. But the woman's suspicions had been aroused, and she set aside her allotments of sugar for a week. She came to court with the little sacks labeled 'Monday, Tuesday, Wednesday' and so on. 'Is this sugar,' she demanded, 'or is it something queer?' We found that the week's ration contained enough bichloride of mercury to kill a horse. In the husband's effects a bottle containing the same poison was found, and this was enough to force a confession."

Analysis of all drugs and narcotics seized by the New York police is another of the big jobs of the crime laboratory. Last year alone more than a half-million dollars' worth of drugs was seized in the New York district. These are found in most surprising forms.

Drug addicts use so much craftiness in procuring narcotics that constant vigilance is necessary to see through their trickery. On Welfare Island, where drug addicts are sent when sentenced, for some time it was suspected that they were getting hold of narcotics. No one could figure out how. One by one various possibilities were discarded until only the mail remained.

ONE day, soon after the mail had been given out, an officer noticed one inmate chewing a piece of paper. He watched for the next letter addressed to that prisoner. With the letter was a piece of

(Continued on page 148)

Fast Life Wrecks the Nerves

by PAUL von BOECKMANN

Lecturer and Author of numerous books and treatises on Mental and Physical Energy, Respiration, Psychology and Nerve Culture

WE are living in the age of SPEED, the mile-a-minute life. We crowd two or five years of life into one. We hurry; we worry; and we dissipate, little realizing that there must come an end to our supply of Nerve Force—that we will become nervous wrecks.

Long before a person reaches the final stages of nervous collapse, he passes through months and even years of sub-normal nerve power, which seriously handicaps him in life, undermines his constitutional powers and causes all kinds of organic and mental disorders. It would be proper to call these people "near-neurasthenics."

There are countless "near-neurasthenics" about us everywhere—in the streets, in the cars, in the theatres, in your business, and especially in your own home—right in your own family.

They are said to be troubled with "nerves," a condition which is not considered serious, but admitted to be most annoying, especially to those who must associate with people who have "nerves."

"Nerves" is not a malady which manifests itself, as many people believe, in twitching muscles, trembling hands. These conditions are found only in advanced stages of Nerve Exhaustion.

The symptoms of Nerve Exhaustion vary according to individual characteristics, but the development is usually as follows: First Stage: Lack of energy and endurance; that "tired feeling." Second Stage: Nervousness; restlessness; sleeplessness; irritability; decline in sex force; loss of hair; nervous indigestion; sour stomach; gas in bowels; constipation; irregular heart; poor memory; lack of mental endurance; dizziness; headache; backache; neuritis, rheumatism, and other pains. Third Stage: Serious mental disturbances; fear, undue worry; melancholia; dangerous organic disturbances; suicidal tendencies; and in extreme cases, insanity.

If only a few of the symptoms mentioned apply to you, especially those indicating mental turmoil, you may be sure that your nerves are at fault—that you have exhausted your Nerve Force.

Perhaps you have chased from doctor to doctor seeking relief for a mysterious "something the matter with you." Each doctor tells you that there is nothing the matter with you; that every organ is perfect. But you know there is something the matter. You feel it, and you act it. You are tired, dizzy, cannot sleep, cannot digest your food and you have pains here and there. You are told you are "run down," and need a rest. Your doctor may prescribe a drug—a nerve stimulant or sedative. Leave nerve tonics alone. It is like making a tired horse run by towing him behind an automobile.

And don't be deceived into believing that some magic system of physical exercise can restore the nerves. It may develop your muscle but it does so at the expense of the nerves, as thousands of athletes have learned through bitter experience.

The cure of weak and deranged nerves must have for its basis an understanding of how the nerves are affected by various abuses and strains. It demands an understanding of certain simple laws in mental and physical hygiene, mental control, relaxation, and how to develop immunity to the many strains of everyday life. Through the application of this knowledge, the most advanced case of Nerve Exhaustion can be corrected.

I have made a life study of the mental and physical characteristics of nervous people, having treated more cases of "Nerves" during the past 25 years than any other man in the world; over 100,000 cases.



PAUL VON BOECKMANN

Author of *Nerve Force* and various other books on Health, Psychology, Breathing, Hygiene and kindred subjects, many of which have been translated into foreign languages

The result of this vast experience is embodied in a 64-page book, entitled "Nerve Force," a book that is essentially intended to teach how to care for the nerves and how to apply simple methods for their restoration. It includes important information on the application of deep breathing as a remedial agent. The cost of the book is only 25 cents, coin or stamps. Address me—Paul von Boeckmann, Studio 162, 110 West 40th St., New York City.

This book will enable you to diagnose your troubles understandingly. The facts presented will prove a revelation to you and the advice will be of incalculable value whether you have had trouble with your nerves or not. Your nerves are the most precious possession you have. Through them you experience all that makes life worth living, for to be dull-nerved means to be dull-brained, insensible to the higher phases of life—love, moral courage, ambition, and temperament. The finer your brain is, the finer and more delicate is your nervous system, and the more imperative it is that you care for your nerves.

"Nerve Force" is not an advertisement of any treatment I may have to offer. This is proved by the fact that large corporations have bought and are buying this book from me by the hundreds and thousands for circulation among the employees—Efficiency. Physicians recommend the book to their patients—Health. Ministers recommend it from the pulpit—Nerve Control, Happiness. Never before has so great a mass of valuable information been presented in so few words. It will enable you to understand your Nerves, your Mind, your Emotions, and your Body. Over a million copies have been sold during the past fifteen years.

What Readers of "Nerve Force" Say:

"I have gained 12 pounds since reading your book, and I feel so energetic. I had about given up hope of ever finding the cause of my low weight."

A physician says: "Your book is the most sensible and valuable work I have ever read on the prevention of neurasthenia. I am recommending your book to my patients."

"Reading your book has stopped that dreadful feeling of FEAR which paralyzed my stomach and digestion."

"Your book did more for me for indigestion than two courses in dieting."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble, but it was simply a case of abused nerves. I have re-read your book at least ten times."

"The advice given in your book on relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time."

"I have been treated by a number of nerve specialists, and have traveled from country to country in an endeavor to restore my nerves to normal. Your little book has done more for me than all other methods combined."



Big Salaries Paid Automobile Experts

Fastest growing industry in U. S. A. offers unusual opportunities to trained men

THE automobile industry is one of the biggest and fastest growing industries in the United States. There are more than 18,000,000 cars registered in this country and the number is increasing every day.

The best way to prepare for success in the automobile field is to study, and there is no better way to do this than through a home-study course with the International Correspondence Schools.

We say this because many of the leading figures in the automobile world today are former I. C. S. students. The list includes Jesse G. Vincent, Vice-President of the Packard Motor Car Co.; Walter P. Chrysler, President of the Chrysler Motor Corporation; E. V. ("Eddie") Rickenbacker; Hiram Walker, Chief Engineer of the Chandler Motor Car Co.; J. V. Whitbeck, President of the Cleveland Automobile Co., and other men equally as famous.

Just mark and mail the coupon and we'll send you information about the I. C. S. Automobile Courses or any other course in which you are interested.

INTERNATIONAL CORRESPONDENCE SCHOOLS Box 7683-D Scranton, Penna.

Oldest and largest correspondence schools in the world. Without cost or obligation on my part, please tell me how I can qualify for the position or in the subject before which I have marked an X:

- | | |
|---|--|
| <input type="checkbox"/> Complete Automobile Course | <input type="checkbox"/> Gas Engine Operating Course |
| <input type="checkbox"/> Automobile Electric Equipment | <input type="checkbox"/> Complete Gas Engine Course |
| <input type="checkbox"/> Electrical Engineering | <input type="checkbox"/> Architect |
| <input type="checkbox"/> Electric Lighting | <input type="checkbox"/> Architects' Blueprints |
| <input type="checkbox"/> Mechanical Engineer | <input type="checkbox"/> Contractor and Builder |
| <input type="checkbox"/> Mechanical Draftsman | <input type="checkbox"/> Architectural Draftsman |
| <input type="checkbox"/> Machine Shop Practice | <input type="checkbox"/> Concrete Builder |
| <input type="checkbox"/> Railroad Positions | <input type="checkbox"/> Structural Engineer |
| <input type="checkbox"/> Civil Engineer | <input type="checkbox"/> Chemistry |
| <input type="checkbox"/> Surveying and Mapping | <input type="checkbox"/> Pharmacy |
| <input type="checkbox"/> Metallurgy | <input type="checkbox"/> Airplane Engines |
| <input type="checkbox"/> Steam Engineering | <input type="checkbox"/> Agriculture and Poultry |
| <input type="checkbox"/> Radio | <input type="checkbox"/> Mathematics |
| BUSINESS TRAINING COURSES | |
| <input type="checkbox"/> Business Management | <input type="checkbox"/> Salesmanship |
| <input type="checkbox"/> Industrial Management | <input type="checkbox"/> Advertising |
| <input type="checkbox"/> Personnel Organization | <input type="checkbox"/> Better Letters |
| <input type="checkbox"/> Traffic Management | <input type="checkbox"/> Show Card Lettering |
| <input type="checkbox"/> Business Law | <input type="checkbox"/> Stenography and Typing |
| <input type="checkbox"/> Banking and Banking Law | <input type="checkbox"/> Business English |
| <input type="checkbox"/> Accountancy (including C.P.A.) | <input type="checkbox"/> Civil Service |
| <input type="checkbox"/> Nicholson Cost Accounting | <input type="checkbox"/> Railway Mail Clerk |
| <input type="checkbox"/> Bookkeeping | <input type="checkbox"/> Common School Subjects |
| <input type="checkbox"/> Private Secretary | <input type="checkbox"/> High School Subjects |
| <input type="checkbox"/> Spanish | <input type="checkbox"/> French |
| <input type="checkbox"/> Illustrating | |

Name.....
Street.....
Address.....
City..... State.....

Occupation.....
If you reside in Canada, send this coupon to the International Correspondence Schools Canadian, Limited, Montreal

INVENTORS who derive largest profits know and heed certain simple but vital facts before applying for Patents. Our book Patent-Sense gives those facts; sent free. Write LACEY & LACEY, 648 F St., Washington, D. C. Established 1869.

INVENTIONS Commercialized
ON A CASH OR ROYALTY BASIS.
PATENTED or UNPATENTED
In Business 25 Years - Complete Facilities - References.
Write ADAM FISHER MFG. CO.,
138-D Enright Av. St. Louis, Mo.

Test Tubes Solve Crimes

(Continued from page 147)

plain white blotting paper. This was sent to a chemist for examination. He found that the paper had been saturated with heroin, a white drug. By chewing this, the addict could obtain the drug as readily as if it were in powder form.

A system of coöperation with business and professional men aids the bureau in tracing clues. Unknown dead, for instance, are often identified by sending a chart of their teeth to dentists. The dentists check these with charts of plates they have made and send in the name of any patient who has a plate similar to that of the dead person.

Laundrymen help by giving their private marks used on linen. These have been the doom of many a criminal.

ABOUT a year ago a veteran safe-blower picked up a 17-year-old boy in Seattle and with him began one of the most remarkable cross country automobile tours of which the police have record. They blew safes in Ogden, Salt Lake City, Denver, Minneapolis, and Cleveland, the boy acting as look-out and driver. Their trail streaked across the northern states.

At Buffalo the safeblowing stopped, and one day in Brooklyn, New York, the boy was caught. At first he refused to speak of his partner. But his acute dissatisfaction over the division of the spoils eventually led him to divulge the name of the older man.

The safeblower had skipped town, and even the boy had no idea where he had gone. He seemed to have dropped out of existence. In his room, when he fled, he had left an old discarded shirt. On the neckband was a typical Chinese laundry mark. Checking this on a list, the laundry was located.

The detectives figured that there was a chance in a thousand that the man might have had some linen in the laundry and would return for it. The old Chinaman kept no records of names or addresses, but trusted only to his memory. A close watch was set up at the laundry, and several weeks after the boy was caught, the safeblower came in for his laundry, and was captured.

ANALYZING liquors and investigating explosives are other tasks of the remarkable criminal laboratory. Taking a bomb to pieces is not the ordinary man's idea of a comfortable job. But with scientific methods even such a dangerous task can be handled safely.

For the moment the bureau is endeavoring to make the police realize the importance of sending in trivial objects found on the scene of the crime. It is hard for the average policeman to realize that a hairpin or broken comb or grease spot, may now become powerful instruments to convict.

Later on, the officials plan to send experts and an emergency kit, with some of the more important instruments, directly to the scene of the crime, along with the photographer and finger print expert. The criminal of the future will have no easy task to plan his perfect crime.



Play Piano BY EAR -in 90 days!

YOU can play real tunes from the start. No notes to puzzle you—no tiresome scales to practice. You need not know a thing about music. Even if you have never touched a piano, if you can hum or whistle a tune, we can teach you to play all popular song hits by ear at a very small cost. No need now to spend years practicing under old time method. My new and original system teaches you easily and quickly. Write at once for

Free Booklet

to show you how easily it can be done. This wonderful home course is offered at a ridiculously low cost. A little practice gives amazing results. You can sit down and play any Popular Jazz piece that you hum. Write us today.—Dept. C.

ILLINOIS SCHOOL OF MUSIC
OF CHICAGO
608 Hearst Square Chicago

Send NOW for FREE Book

SIGNS and SHOW-CARDS PAINTING MADE EASY

You, too, can paint attractive signs and show-cards with the aid of Letter Patterns. Simply trace around the letter pattern and fill in. You will be astonished how quickly you can paint a sign by this method. These patterns are cut from durable oiled stencil board with smooth edges, which allow for rapid outlining. Each alphabet contains all the letters and the character &. Send stamp for free samples or better still order a few sets.

ABC No. 1	ABC No. 4	ABC No. 8	ABC No. 13	ABC No. 18
ABC No. 2	abc No. 7	123 No. 9	abc No. 14	abc No. 19
123 No. 3	123 No. 6	ABC No. 5	123 No. 12	123 No. 20

Price Each Alphabet, 1½ in. 50c, 2 in. 60c, 3 in. 75c, 4 in. 95c, 6 in. \$1.50. Nos. 7, 14, and 19 Lower Case made only as follows: 1 in. 50c, 1½ in. 60c, 2 in. 60c, 3 in. 75c.

Price of Set of 10 Numerals, 1½ in. 25c, 2 in. 30c, 3 in. 35c, 4 in. 45c, 6 in. 70c. Order by Number and give size. All orders from this advertisement receive prompt attention and will be sent by parcel post.

JOHN F. RAHN 2120 No. Neva Ave., Chicago, Ill.

PATENTS

Trade-marks, Copyrights, Patent Litigation, Handbook with illustrations, 100 mechanical movements. Sent free on request.

ALBERT E. DIETERICH

Formerly member Examining Corp. U. S. Patent Office
Patent Lawyer and solicitor
27 years' experience
681-A Ouray Bldg. Washington, D. C.

PATENTS

BOOKLET FREE HIGHEST REFERENCES
PROMPTNESS ASSURED BEST RESULTS

Send drawing or model for examination and report as to patentability

WATSON E. COLEMAN, Patent Lawyer
644 G Street N. W., Washington, D. C.

Wrestling Book FREE



Learn to be an expert wrestler. Know scientific wrestling, self-defense, and jiu-jitsu. Develop a splendid physique, and have perfect health. Join this popular school and learn by mail. The famous world's champions—the marvelous

Frank Gotch and Farmer Burns

offer you a wonderful opportunity. Wrestling is easily and quickly learned at home by mail. Men and boys write now for splendid free book. Learn all the science and tricks. Be able to handle big men with ease. Accept this wonderful offer NOW. Send for free book today, stating your age.

Farmer Burns School of Wrestling, 1713 Range Bldg., Omaha, Neb.

Getting Ahead?

Read the advertisements on Pages 128F to 158 this issue if you want to get ahead!

\$351⁰⁰ CLEARED IN ONE DAY

So writes W. H. Adams of Ohio in August 1925. V. A. Marini of California reports \$11275 sales in 3 months. Jacob Gordon of New Jersey "\$4000 profits in 2 months." Alexander of Penna. "\$3000 profits in four months." Ira Shook \$365 sales in one day. Bram bought one outfit April 5 and 7 more by August 28. Iwata, bought one outfit and 10 more within a year. Mrs. Lane of Pittsburgh says "sold 8000 packages in one day." J. R. Bert says "only thing I ever bought that equaled advertisement." John Culp says: "Everything going lovely. Crispette wrappers scattered all over town. It's good old world after all." Kellogg, \$700 ahead end of second week.



WE START YOU IN BUSINESS

Furnish secret formulas, raw material and equipment. Little capital required; no experience needed.

Build A Business of Your Own

No limit to the sale of Crispettes. Everybody likes them. It's a delicious food confection. Write for facts about a business that will make you independent. Start now, in your own town.

Profits \$1000 a Month Easily Possible

Send postal for illustrated book of facts. It contains enthusiastic letters from others—shows their places of business, tells how and when to start, and all information needed. Free. Write now!

LONG-EAKINS COMPANY
347 High Street Springfield, Ohio



Here's your chance to get 4 beautiful Rayon Silk Fibre Knitted Ties at factory prices—direct from the mill that weaves them.

You save the jobber's and retailer's profit. We send you the ties on 3 days' approval. If you like them, you send your check or money order for \$1.50 within 3 days. Or you return the ties in the accompanying stamped container.

No C. O. D. to pay postman—nothing to pay if the ties don't suit you. Just write on a post card, "Send the 4 ties," and you'll get them postpaid by return mail.

GOVERNMENT SQUARE KNITTING MILLS
117 Government Square Cincinnati, O.



New Way to Make Money at Home

Do you need money? National organization, Fireside Industries has a few openings for new members. Wonderful, easy way to earn money every day right in your own home. Fascinating, pleasant work. No experience needed. We teach you everything.

FREE Book Tells How

Beautiful FREE Book explains how to become a member of Fireside Industries, how you earn money in spare time at home decorating Art Novelties, how you get complete outfit without one penny of extra cost. Write today, enclosing 2c stamp.

FIRESIDE INDUSTRIES, Dept. 51-C, Adrian, Mich.

He Freed Women from Drudgery

(Continued from page 32)

Howe's consciousness. He had ambitions far beyond any he had ever voiced. His work in Davis' shop had taught him that he had talents better than the ordinary for understanding and utilizing mechanical equipment. Some of his fellow workmen surpassed him in skill with tools. None, though, surpassed him in ingenuity. All of this to this wideawake youth suggested a career as an inventor. Yet, just like the young inventors of today, he found a huge obstacle before him, the question, "What shall I invent?"

And, then and there, young Howe knew that this question had been answered for him; that he had taken the first step in surmounting the obstacle. A sewing machine! It met all the requirements of the successful invention. It was useful. It filled a human need. Its application was wide, almost infinite.

THE young mechanic found himself strangely exalted. He went to his lodgings that night walking on air. The road to fortune had opened up before him.

And then for almost six years Howe did nothing more than think about his invention! It wasn't laziness, lack of courage or anything of that sort. On the contrary, the fact that he continued to think of a sewing machine instead of putting the idea out of his head as impractical is proof conclusive of Howe's courage and steadfastness. The trouble was that the machine failed to assemble itself properly in Howe's mind.

After six years, however, in 1843, Howe's idea received an impetus from two mighty forces—love and necessity. The young mechanic had married, and was the father of three children. Howe's returns from his work in Davis' shops failed to keep pace with his added responsibilities. To complicate matters further, instead of being merely physically frail, he became actually ill. There were times when he could not work at all, and his young wife, in an endeavor to make up the deficit in the family budget, began to sew for the neighbors.

It was torture to one of Howe's self-reliant and sensitive spirit to watch his bride become hollow-eyed and stoop-shouldered from long days and nights spent plying her needle. For all his brooding over the idea of a sewing machine, never had he realized the crying necessity for the invention until it was thus brought home to him. He determined to wait no longer for the detailed plans of the machine to form themselves in his mind, and began the construction of a machine by the "cut and try" method—experiment. His first efforts—and they lasted for a year—were flat failures.

HE persevered with his efforts, building machine after machine. Each one, though, failed to sew. And then suddenly it occurred to him that all along he had been on the wrong track. What he required was not an automaton that would imitate more or less faithfully the move-

(Continued on page 150)

Learn to Draw at Home



Make Your Salary \$100⁰⁰ a Week

Everywhere there is a big demand for artists—newspapers, magazines, advertising agencies, department stores, everyone who advertises is glad to pay big money for artists who can produce pictures and illustrations with commercial value.

Learn At Home This Quick Easy Way

Our wonderful method makes it possible for anyone to learn Illustrating, Cartooning, or Commercial Art. Most of our students never touched a drawing pencil before they studied with us, yet hundreds of them are now making splendid incomes. You can do the same. The simplicity of this amazingly simple way will astonish you. No matter what your present ability—no matter whether you think you have "talent" or not—we can teach you to draw—and draw well.

Simple Way Makes Success Easy

Our easy way simplifies everything. You start drawing with straight lines, then you begin using curves, and before you realize it you are drawing pictures with shading, action and perspective. And you are taught all the "inside secrets"—the "tricks of the trade" that would otherwise take you years to learn. Our Art Director has had years of experience in commercial art. He knows the kind of pictures that sell and he teaches you how to make them—in the least possible time.

Write for FREE BOOK

An interesting and handsomely illustrated booklet, "Quick Easy Way to Become An Artist," will be sent you without cost.

Mail this coupon for it. Learn how you can easily become an artist in a few minutes' daily spare time. Get also full particulars about our "Free Artist's Outfit" offer. Send the coupon NOW!

The Washington School of Art, Inc.,
Room 243-D. 1115-15th St., N. W., Washington, D. C.

The Washington School of Art, Inc.
Room 243-D, 1115-15th St., N. W.,
Washington, D. C.

Please send me without cost or obligation on my part your free book, "Quick Easy Way to Become an Artist." Print name plainly.

Name.....
(Mr. Mrs. Miss)

Address.....

City.....State.....

LEARN to FLY

1000 Ambitious Young Men
WANTED



Aviation Mechanics—\$50-\$125 Week
Riggers—\$50-\$75 Week
Flyers—\$125-\$225 Week
Taxi Service—\$100-\$300 Week
Aerial Photo Pilot—\$200-\$250 Week
Special Messenger Service—\$125-\$200 Week
Aerial Advertising—\$225-\$500 Week.
Crop Dusting—\$125-\$200 Week
Crop Survey—\$125-\$225 Week

SWEENEY SYSTEM

of Practical Airplane Mechanics opens up a world of opportunities for young men. You Learn by Doing!

THIS photograph shows Instructors Wimer and Spencer working with students. The Sweeney System first prepares a student by intensive practical work on motors, building, recovering wings, rigging and all details of construction, repairing and handling. This is called ground school work. Instructor Spencer, an overseas flyer, tells you that it took about 4000 mechanics and assistants to keep several hundred flyers in the air at his field in France. To show you the quality of the men who teach you look at Spencer and Wimer for instance. Spencer was an army pilot and has been teaching and doing commercial flying since 1917. Wimer is a college man, went overseas, was with the 1st Air Park, was an observer, spent over 200 hours in the air and since the war has been with two big aircraft corporations.

THE SWEENEY SYSTEM

is divided into two parts. FIRST: You are thoroughly taught in the ground school. This fits you as an aviation mechanic. You can build your own plane and do anything required in aviation mechanics and construction and repairing when you have finished this work. You are thoroughly taught motors, etc., and work with thousands of dollars worth of new material, including all types of engines. Liberty 12s, Sturdevant 3, Gnomes, Hall Scott fours and sixes, etc.

SECONDLY: after completing this work if you want to be a pilot you take ten hours of flying. Now when you understand that two to seven hours is all the average man needs to learn expert flying you will appreciate what ten hours in the air under skilled men will do for you.

LEARN TO FLY! Aviation is no longer a mystery—no longer a hazard; no, it is a business growing greater and more important; you can qualify as a mechanic, or an engineer, or repair man, or builder: five men on the ground are needed for one man in the air, but if you want to become a pilot you easily master the work and can go into postal, government, or commercial work. Flyers are in demand, earning big money at fairs taking up passengers, etc. \$5 for a 10-minute flight is pretty fine pay!

SEND NAME TODAY for full details of this aviation mechanical course and photographs of planes and equipment actually used; also full information as to the commercial end of flying and opportunities for young men.

LEARN TO FLY BY FLYING
Sweeney
SCHOOL OF AVIATION
308 SWEENEY BLDG., KANSAS CITY, MO.

SEND THIS NOW

EMORY J. SWEENEY, President
2308 Sweeney Bldg., KANSAS CITY, MO.
Please send me full information about your Aviation Course.
Name.....
P. O.
State.....Age.....

He Freed Women from Drudgery

(Continued from page 149)

ments of a woman in sewing, but a machine that would accomplish the same results in its own way. A lock-stitch—thread fed from both above and below the cloth simultaneously and joining together, instead of a single strand moving in and out—an eye placed not at the blunt end but just above the point of the needle—here was the solution!

The idea seized him with such overwhelming force that almost before he knew it he had quit his job with Davis to devote his whole time to the development of his machine. His friends and his neighbors expostulated with him, some abusively, calling him a fool and a shirker thus to cast aside the duty he owed his family to pursue a will-o'-the-wisp.

His wife with noble courage redoubled her efforts to earn for the family and bade her husband proceed with his invention. His father, with equal faith in his ultimate success, offered him and his family a home on his farm. Before the end of 1844, Howe had completed a model machine.

AT THIS juncture, with his goal virtually in sight, Howe was forced to quit work on his invention through lack of funds. Desperate, he at last demonstrated his model to George Fisher, a fuel dealer of Spencer. The latter was impressed favorably, and offered \$500 to Howe for materials and tools in return for a half-share in the invention if it proved patentable. Howe agreed, and by April, 1845, had produced a machine that sewed smoothly and evenly.

After sewing a suit of clothes for Fisher and one for himself, Howe invited several Boston tailors to inspect his machine. They declined, so he took his model to the Quincy Hall Clothing Factory and for two weeks demonstrated it to all who visited the place. But human nature's proverbial distrust of anything new held people off. Boston remained indifferent, unfriendly even, both to the invention and its inventor. Howe gritted his teeth and set to work building a second model for the Patent Office in Washington.

During the nine years he had been dreaming about and working on his invention, it had seemed to Howe that with the patent papers in his hand his long struggle would be over. On the contrary, though, discouragements worse than any he had experienced before arose to confront him. He exhibited his machine at a fair, but no one would either buy it or rent it. Fisher, who had financed Howe to the extent of \$2,000, began to complain. Wherever he showed his machine it met either indifference or ridicule. Slowly but certainly, poverty, ill-health and his failure to arouse public interest in his invention began to undermine Howe's morale.

HE SENT his brother to London, and the latter succeeded in selling one of Howe's machines to a corset manufacturer named William Thomas for 250 pounds. Then Howe himself went to England with his family and for a paltry

(Continued on page 151)

\$93 FREE the First Week
\$123 Selling Outfit To AGENTS in 36 Hours
\$10 in One Evening
Wonderful NEW Invention Stay Prest Trousers Presser

Latest thing out—New Stay-Prest Trousers Presser—is selling like wildfire. Four patents put in lasting crease. Removes wrinkles and bagginess. Cuts tailor bills. Folds to 15 inches. Demonstrates in 40 seconds. Men buy one to six. 1,000,000 sold already.
"My first week I made \$93," writes S. L. Patterson, Iowa. You, too, can make big money. Others cleaning up.
Your profits in advance. Simply write orders. We deliver and collect. Big commissions.
See how easy it is to sell Stay-Prest. Test it without cost. Write for further facts and offer of free demonstrator. With millions of prospects—you can't avoid making extra dollars. Send postal card for Free Offer today.
The Getgey-Jung Co.
C-143 G. & J. Bldg., Cincinnati, Ohio
Canadian Distributor: Street & Bourke Co., 110 Dundas St., London, Ontario, Canada
FOUR PATENTS

\$25.00 DRAWING COURSE for \$2.98



Haven't you often wished that you could draw cartoons, illustrate some idea, sketch some pretty face, etc.? You can do all of these things. One of America's most famous Cartoonists and Illustrators has developed a great, simple system for success in all branches of Commercial Art. This system has revolutionized the entire theory of drawing. It means that drawing can be as easy for you as writing—much simpler than learning shorthand, bookkeeping or typewriting. We are now placing this original system for learning Drawing, Art and Cartooning, consisting of 34 lessons with over 500 illustrations, within reach of every one. If you will devote a few hours each week to the course WE ABSOLUTELY GUARANTEE that you will learn to draw and draw well before you have half finished the Course. If we fail to make this claim good, we will refund every cent paid us.

By eliminating a large office force for answering correspondence, expensive catalogs, etc., we are enabled to make a price of \$2.98, the cheapest price ever known for a high-grade, home study course. Many have sent us letters similar to that of Rob't P. Davis of Detroit, who wrote: "I can't see how you ask so little, when others with inferior Courses get from \$20 to \$60 for theirs. It is more than I expected." Learn to draw. It is a big asset, no matter what field you are in.

Send No Money

Just order the Course, and on arrival pay postman \$2.98 plus a few cents postage, payment in full for the entire Course and Drawing Outfit. If not entirely satisfied, return within five days and we will REFUND MONEY. Address

LEDERER SCHOOL OF DRAWING,
Dept. 1032-L, Chattanooga, Tenn.
Orders from outside the U. S. A. are payable \$3.28 cash with order.

LAW Free Book

Write today for FREE 128-page book, "THE LAW TRAINED MAN," which shows how to learn law in your spare time and earn more money. Qualify for a high-salaried executive position or prepare to enter the practice of law. Study at home through the Blackstone Course prepared by 80 prominent legal authorities including CHIEF JUSTICE WILLIAM HOWARD TAFT. Blackstone graduates practicing law everywhere. LL.B. degree conferred. Magnificent 25 volume law library furnished immediately upon enrollment. Moderate tuition fee. Low monthly terms. Money Back Guarantee. Write for book today. 4753 Grand Blvd., Blackstone Institute, Inc., Dept. 123 Chicago
America's Foremost Non-Resident Law School

Getting Ahead?

Read the advertisements on Pages 128F to 158 this issue if you want to get ahead!

He Freed Women from Drudgery

(Continued from page 150)

weekly wage spent eight months in building a special corset machine for Thomas. When the manufacturer sought to persuade Howe to remain with him on the same terms to "execute miscellaneous repairs," the inventor declined, sent his family back to America, and began the construction of another machine.

When this was finished, Howe had not a cent. He sold the machine for five pounds, taking a promissory note in payment. This he discounted and sailed for home, landing in New York with 60 cents in his pocket. Within a few months of his arrival his wife died of tuberculosis, and Howe, sadly bruised in spirit, sought work as a journeyman machinist.

Broken in health by overwork, worry, and the privations incidental to poverty, Howe had every reason to believe that fate had marked him for a failure. His days were filled with exhausting work, his nights with bitter memories.

AND then one day came to him the astounding tidings that the sewing machine he had invented was proving a great success! It was a success, though, in which he was not sharing, for others had seized on his invention during his absence in London and were reaping a harvest.

It was a situation that would have daunted any man. And yet, penniless and sick, with his original model and his patent pledged for debt in London, Howe determined to fight. His backer, Fisher, seeking to save what he could from what seemed an impossible wreck, sold his half-interest in the invention to George Bliss. The latter yielded to Howe's importunities and agreed to advance money to attack the infringers of the sewing machine patent.

Through court after court the suit dragged. Howe, ill most of the time, lived from hand to mouth while his meager earnings went to defray the costs of this seemingly endless—and hopeless—litigation. And then in 1854—seventeen years after the idea of a sewing machine had first taken root in Howe's mind—Judge Sprague, of Massachusetts, decided that Howe's patent was valid and that all subsequent manufacturers of sewing machines would have to pay tribute to him.

THIS momentous decision came just in the nick of time for the man whose unconquerable devotion to his life's work in spite of poverty, sickness and neglect, probably is not matched in the annals of inventive science. Howe's patent had only one more year to run. But so extensive had the manufacture of sewing machines become that money began to flow into the pockets of the hitherto impoverished inventor in a flood that bewildered him. Up to the time that his extended patent expired in 1867, Howe's royalties, it is estimated, amounted to not less than \$2,000,000, a staggering sum in that period.

In that same year Howe died. He lived but a few years to enjoy his victory,—long enough, though, to see the results of his life's work recognized and rewarded.

Easy as A-B-C



Here's a Queer Way To Learn Music!

No teacher—no monotonous exercises. Just a simple, easy home study method. Takes only a few minutes—costs only a few cents—a day. Every step as clear as A.B.C.

WHO would have ever thought that the learning of music could be simplified. Seems almost too good to be true to think of learning to play your favorite instrument without long hours of practice—tedious scales and expensive teachers, doesn't it? Yet that's exactly how you learn this new way. The only thing that is queer about this amazing method is the fact that it's so different from all ordinary methods.

But although this marvelous home study method is different and comparatively new it has already been carefully tested and proved by almost half a million people all over the world. Judge from that how satisfactory, reliable and easy it must be.

Musical Talent Not Needed

Even if you have never touched an instrument before you can't go wrong this amazingly easy way. For every step, from beginning to end, is right before your eyes in print and picture. You always know what to do and how to do it. No guesswork. No delays. If you make a mistake you correct it yourself and continue. It's really fun learning to play this way, you proceed so rapidly. From the start you are playing real tunes perfectly by note. And almost before you realize it you will be able to play anything—the popular "Jazz" or those classical selections for which there is always a big demand at concerts and home entertainments.

Best of all no matter which instrument you choose the cost of learning is just the same in each case, just a few cents a day!

Have Fun—Win New Friends

Just think of all the pleasure you've been missing by not being able to play some musical instrument. Instead of being the center of attraction at parties—you've been unnoticed—out of the social picture.

While you've been playing wallflower others

have always had something to offer. Now you have a wonderful chance to turn the tables—to treat yourself to some real fun—to surprise your friends! Take some good advice. Learn to play this new easy way. Get your share of a musician's pleasure, popularity, profit. Start Now!

Free Booklet and Demonstration Lesson

If you are in earnest about wanting to join the crowd of entertainers and be a "big hit" at any party—if you really do want to play your favorite instrument, to become a performer whose services will be in demand—fill out and mail the convenient coupon asking for our Free Booklet and Demonstration Lesson. These explain our wonderful method fully and show you how easily and quickly you can learn to play like a professional at little expense. Instruments are supplied when needed—cash or credit. U. S. School of Music, 83 Brunswick Bldg., New York City.

U. S. SCHOOL OF MUSIC,
83 Brunswick Bldg., New York City.

Please send me your free book, "Music Lessons in Your Own Home," with introduction by Dr. Frank Crane, demonstration lesson and particulars of your special offer. I am interested in the following course:

Have you the above instrument?

Name
(Please Write Plainly)

Address

City State

Make More Money

Read the Money Making Opportunities on pages 128F to 158 of this issue.



WANT \$2700 A YEAR?

Become Railway Mail Clerks
Men—Boys—18 Up

ALL POSTAL SALARIES JUST RAISED.
MAIL COUPON BEFORE YOU LOSE IT.

Steady Work—No Layoffs—Paid Vacations

Travel—See Your Country

COMMON EDUCATION SUFFICIENT

Franklin Institute, Dept. M-274 Rochester, N. Y.
Sir: I want to travel and see the country. Rush to me without charge, (1) Sample Railway Postal Clerk Examination questions; (2) tell me how to get a U. S. Government job; (3) send list of places at which examinations will be held.

Name

Address



Increase Your Pay in Cartooning

\$50 to Over \$250 a Week Paid to Good Cartoonists! And You Can Easily Learn This Fascinating Profession Right At Home in Spare Time. Free Booklet Explains This Easy Method. Send For It Today.

There isn't a more attractive or highly paid profession today than cartooning. Millions of dollars are spent every year for good cartoons by the 20,000 or more newspapers and magazines in the United States alone. Capable artists earn from \$50 to over \$250 a week. In fact, there is no limit to its possibilities. Fontaine Fox, Briggs, Bud Fisher, Sid Smith and the other headliners **make more money** than the presidents of most corporations. Think of it!

Quick Easy Way to Learn Cartooning

Yet of all the professions cartooning is now positively one of the easiest and simplest to learn. You don't have to know a thing about drawing. You don't need to have ever tried to make cartoons. Through our amazingly simple method many who never dreamed they could draw have easily learned cartooning. You too—without the slightest previous training—without any apparent talent at all—can easily learn to dash off side-splitting cartoons that may mean ease and independence for you and yours—within a surprisingly short time. You learn right at home, yet your work receives the personal attention and criticism of one of America's foremost artists. So rapid is the course that many students actually sell enough work during their training to pay for it.

Mail Coupon for Free Book

Learn more about the wonderful money-making opportunities in cartooning, and how this method makes it easy for you to learn. Read about our students—their success—what they say—how easy it was—actual reproductions of their work—how they made big money while studying. This amazing little book may mean the turning-point in your life. Send for it today. It is yours without cost or obligation. Mail coupon NOW.



Washington School of Cartooning
Room 243-D, 1113-15th St.,
N. W., Washington, D. C.

WASHINGTON SCHOOL OF CARTOONING,
Room 243-D, 1113-15th St., N. W.
Washington, D. C.

Please send me without obligation, your illustrated
FREE BOOKLET on Cartooning.

Name.....
(Write Name Plainly)

Address.....

City.....State.....

If under 16 years, please state age.....

Do Athletes Die Young?

(Continued from page 35)

people. Of course, there have been early deaths among the runners and jumpers and weight throwers. Lon Meyers, who in the early 'eighties won national championships at every distance from 100 yards to a half-mile, died at the age of 41. Martin Sheridan, New York policeman and Olympic Games winner in 1904, 1906, and 1908, died at the age of 37. But Arthur Duffy, who, in 1902, was the first man to run 100 yards in 9½ seconds, time that never has been beaten, and Maxie Long, whose record of 47 seconds for 440 yards on a straightaway course, made a quarter of a century ago, still stands, are alive and well. So are Alfred Shrubbs, the English distance star of twenty-odd years ago, and Hannes Kolehmainen, the original "Flying Finn."

Added evidence that track and field athletics do not shorten life is that every one of the ten men who were members of the University of California track team that competed in the East in 1895 is alive today.

Tennis has lost Robert D. Wrenn, but there is no proof that strenuous tennis tends to shorten life. Every one of the men on the English and American Davis Cup teams of 1900 was alive in 1925. Dwight F. Davis, now secretary of war, was one of the holders of the national doubles championship in 1898 and 1899. Norman E. Brookes, the world-famous Australian "old master," plays a dangerous game at the age of 47.

KNOWING when to let down, and when to quit, helps athletes to keep out of the early-death class. Eugene J. Giannini, an oarsman, and coach of the New York Athletic Club crews, died in 1923 at the age of 57. Mr. Giannini refused to acknowledge the marching years, and his death was the result of his heart's failure to stand up under the strain of running a brisk mile on the track.

Rowing is the most strenuous of all sports. It has been determined by Yandell Henderson and Howard W. Haggard, professors of applied physiology at Sheffield Scientific School, Yale University, that each oarsman in an eight-oar shell pulls 15,015 foot-pounds a minute in a race—which means that each minute he does work equal to climbing the stairs of an eight-story building.

William H. Geer, director of physical education at Harvard University, made a study of the records of 159 oarsmen who rowed on Harvard crews between 1852 and 1900. He found that in 1900 there was a record of 67 deaths. According to the American Experience Tables of Mortality the number of expected deaths for the group was 92. Only 69 per cent of the normal number of deaths for the group had occurred, and other calculations showed that the average life expectancy of the oarsmen was 4.27 years above normal.

Desiring to obtain the opinion of an accepted authority on the question, "Do athletes die young?" I went to see Dr. William G. Anderson, director of the Yale University gymnasium.

(Continued on page 153)

Dental Laboratory EXPERTS Wanted!



H. A. McCarrie
A Leader in the field of Mechanical Dentistry

Get into the great new profession:

"Mechanical Dentistry"

Biggest opportunity for success of the Century, because there are more jobs open than Experts to fill them, in Dental Laboratory work! Salaries \$60 to \$125 a week. Learn quickly in my big schools at Chicago, Detroit, Cleveland, Boston or Philadelphia. Individual, *personal* instruction on actual laboratory work with standard tools and materials. No classes or text books here. Day or evening instruction.

70,000 Dentists buy Dental Laboratory work!

Only a few hundred Dental Laboratories in the U. S. today. *Hundreds more are urgently needed in every city!* Dentists can't afford to do their own Laboratory work. But they must have a Laboratory in their own city to get rapid service.

More Laboratories Needed! Prepare to open one

My training includes thorough practice in the making of crowns, fixed and removable bridge-work, rubber and metal plates, etc.—every branch of the work from actual impressions. In addition we instruct you in Laboratory management—how to handle orders, how to build a business of your own, how to buy, what to charge, etc. Many graduates open their own Laboratories and are prepared for well-paying positions.

TO ALL STUDENTS

Mail Coupon for R. R. Fare Offer:

FREE!
R.R.
Fare

Railroad fare allowed to Chicago, Boston, Detroit, Cleveland or Philadelphia — the school nearest you. Employment Service provides spare-time positions for those who wish to work days or evenings while attending school. We help our graduates find positions.



Mail coupon immediately for limited special offers.

McCarrie School of Mechanical Dentistry

Dept. 1502-C, 1338 S. Michigan Ave., Chicago, Ill.

Without obligation please send me your FREE R. R. Fare Offer and free catalog with complete information about how I may become a Dental Laboratory EXPERT.

Name.....

St. No.....

City.....State.....

Do Athletes Die Young?

(Continued from page 152)

"No," said Dr. Anderson decidedly, in answer to my question, "the Yale athlete does not die young. Recently I made a study of 808 athletes who won the 'Y' between 1855 and 1905. There had been 58 deaths—46 per cent of the expected deaths for the group according to the American Mortality Tables. The ratio of actual to expected deaths of crew men was 41 percent, of football players and track athletes, 52 percent, and of baseball players, 42 percent. The only athlete who ever won the 'Y' in four sports is alive and apparently in good health today."

"DO MANY athletes, or ex-athletes, die of 'athletic heart'?" I asked.

"Few athletes die of heart failure," replied Dr. Anderson. "Of the 58 deaths recorded in the study of 808 winners of the 'Y,' only four were caused by heart disease. The same number of deaths was caused by drowning. The heart-failure deaths occurred at the ages of 35, 57, 68, and 70. Heart disease seems to be increasing, but the deaths are among elderly men, as a usual thing, and do not exceed the expected deaths among non-athletes of the same ages."

"Lung trouble seems to be the athlete's most dangerous enemy. Of the 58 deaths studied, 12 were caused by tuberculosis, six by pneumonia and two by typhoid pneumonia. But the percentage of men dying from these causes is not greater than the expected deaths among non-athletes from similar causes."

"The athlete must remember that he does not stay young forever. At 50 he cannot do with safety the things he was accustomed to do at 25. Exercise is a fine thing for most men, but after 40 it should be taken with care and in moderation. The ex-athlete must begin to slow up before something breaks."

Dr. James H. McCurdy, head of the physical department of the International Y.M.C.A. College in Springfield, Mass., who has devoted much of his life to the work of training young men to become physical directors, and who has studied the subject of exercise with scientific thoroughness, also says that athletes do not die young.

"WHAT are the longevity chances of the prominent sport stars of today?" I asked him; "Men like Red Grange, Paavo Nurmi, William Tilden, and Jack Dempsey?"

"Their chances of long life depend mostly on their habits while out of training," replied Dr. McCurdy. "Athletes, as well as non-athletes, have been known to eat themselves into the grave. A moderate life usually is a long life."

"The great athlete," he continued, "has a little better chance of a long life than has the non-athlete, not because he is an athlete, but because—I am speaking generally, of course—he was a better human machine in the beginning. Perhaps proper training for sport lengthens a man's life—but that never has been proved. It has been proved, however, that athletes do not die young."

Don't Gamble with Your Future

Is the U.S. Gov't's Choice Good Enough for You?

A PRACTICAL ELECTRICAL SHOP COURSE

(Not a Correspondence School)

This is the U. S. Government's own Veteran's Bureau course, which we took over when Congress decided it had served its purpose for the veterans. Now this opportunity is open for you—to make your start quickly in this most fascinating, big pay work—Practical Electricity. The World's greatest progress is right in this field. Right now the opportunities are unlimited and the quicker you get this training, the bigger success you will make.

SPECIAL OFFER NOW!

for men who enroll immediately. In 12 weeks you can get the training that will put you in a real electrical job. Think of it! Before spring is over you will be started in this most interesting work—with big pay and a bigger future. Send right now for our Free Electrical Book and this special offer. Use coupon below.

Learn Quickly—Thoroughly

Here you learn by actually doing electrical problems—under supervision of electrical experts. That is absolutely the only way you can really learn electricity.

The same chief instructor is in charge who developed this school for the Government. The same training system is being followed—the plan that has proved to be the most practical ever devised for initiating men into the money-making end of electricity.

Best and Most Complete Equipment

In addition to the equipment bought from the Government school, we have added many new features. We have recently taken over completely one of the largest strictly radio schools in the country.

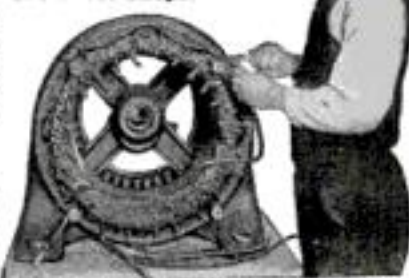
We have over 200 motors—of practically every kind, type and make in the world—also nearly every kind of motor starter used in the industrial field. All of these are for the use of students in making experiments: taking apart, reassembling and hooking up as required by various jobs during the course.

Over 300 testing instruments—voltmeters, ammeters, etc.—some costing as high as \$400 each. Complete armature and stator department, with up to date equipment for winding, taping and forming. A bungalow—right in the shop—for learning house wiring. Apparatus for testing action of motors and starters under different loads. Rotary converters, alternating current generator, high tension line, automatic telephone panel—you learn about these and many other devices—by actually using them for real electrical problems.

Made Simple and Easy

Our remarkable training plan makes the course doubly interesting and very easy. Simple experiments begin the very first day—with a friendly, helpful instructor always at hand.

An experiment on a stator, in the Greer Shops.



One great advantage of our system is that you get individual attention. You go ahead as fast as you are able. No one is held back because someone else is slow.

We Pay R. R. Fare to Chicago—Tools Included Free

We pay railroad fare to Chicago on all cash enrollees. The tool set is included—absolutely free—regardless of what payment plan you use.

Free Employment Service

Our employment department has more jobs than it can fill at the present time. We help you get the right sort of job, and we stand back of you for life with help and advice.

You may return at any time—without charge—to "brush up" on any subject, or to learn about latest developments and inventions.

The employment department provides part time jobs for men who wish to earn extra money while in training.

Send This Coupon NOW

Do not delay and let this chance slip by. Send the coupon right now, and by return mail you will get our free electrical book and full information about our amazing offer.

Write or print your name and address very carefully, please, clip the coupon and send it in at once.

Erwin Greer, President, Greer College, Electrical Division, Dept. 302, 12224 S. Wabash Ave., Chicago.

Please send me your free book and offer for Electrical course. It is understood I am not obligated in any way.

Name.....

Address.....



Are You Timid or Self-Conscious?

Bashfulness, timidity, blushing, confusion and self-consciousness can be quickly mastered. Interesting, instructive, illustrated FREE TREATISE tells how to attain poise and a charming personality, gain courage, control and confidence, and win success in love, social or business affairs. Sent free and postpaid. Write for it TODAY. RESEARCH INSTITUTE, Station 7, JACKSON, MICH.

COPY THIS SKETCH

and let me see what you can do with it. Cartoonists trained by this school are earning from \$50.00 to \$200.00 or more per week. The Landon Picture Chart Method of teaching makes original drawing easy to learn at home in spare time. Send sketch with 6c in stamps for full information and sample chart to test your ability. Please state age.

THE LANDON SCHOOL
1451 National Bldg. CLEVELAND, O.



A BETTER JOB NOW—FOR YOU

Earn \$2,000 to \$10,000 a Year!

Why work for small pay? Learn a good trade. Know autos—how to repair them. Get a better job—Now! Or a business of your own. Learn in a few weeks here at the great auto-trade school in the heart of the auto industry. Think of the repair work on eighteen million cars! There are not nearly enough trained men to do this work. **TRAINED Auto Men Are Wanted!** You can be a skilled mechanic and auto electrician and **Earn Big Money.** Experience not necessary. If you are mechanically inclined come to Detroit now to the Old Reliable "Michigan State."

Learn Autos in Detroit THE HEART OF THE INDUSTRY

Here you have wonderful advantages. Study autos, trucks, engines, auto electricity, tractors. All on best equipment, up-to-date. Many new cars including Packard "Straight Eight" with four wheel brakes, Buick Six (four wheel brakes), Oakland (four wheel brakes), new Oldsmobile, Hupp, Reo, Hudson, many others. Hundreds of engines and electrical systems. Expert instructors to teach you; a thorough course that slights nothing. Visit the great plants of Ford, Cadillac, Packard, Lincoln, Dodge, Hupp, Hudson, Studebaker, many others. These great companies endorse this School. Get factory endorsed training at Detroit, the Auto Center. **Good Positions Open.** Here's your chance to be independent. The demand for trained auto men is greater than the supply. Opportunities everywhere. Write today for full information about Detroit training to make the most money.



Michigan State Automobile School
583 Auto Building Detroit, Michigan

GET THE FACTS—TODAY!

MICHIGAN STATE AUTOMOBILE SCHOOL,
583 Auto Building, Detroit, Mich.

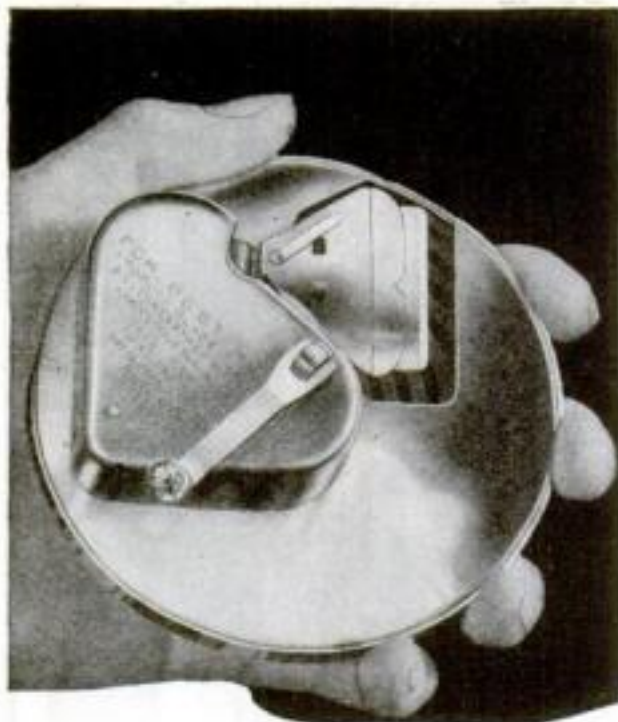
Send me FREE and without obligation complete information about Detroit training to make the most money.

Name.....

Street or R. F. D.....

City.....State.....

I am interested in ☐ Resident Course at your school.
☐ Home Study Course.



**Use This
Amazing
Invention
and**

**I'll Guarantee
To Keep You in
Razor Blades for Life**

**Sensational New Invention Guar-
antees You 365 Slick Shaves a
Year—No More Blades to Buy!**

KRISS-KROSS marks such a radical advance in shaving comfort and economy that it deserves to be called much more than a stropper. Rather it is a blade rejuvenator. Makes hundreds of keen, quick shaves blossom where only one grew before.

Kriss-Kross strops your blade on the diagonal just like a master barber. Pressure decreases automatically. Nickel jig flies up to notify you when your blade is ready, with the keenest cutting edge that steel can take!

And now for my smashing offer! For 30 days only, to introduce KRISS-KROSS stropper, I will give you an amazing new kind of razor free. Really 3 razors in one. Can be made straight or T-shape in a jiffy. Five special blades free, too.

Use these blades and keep renewing them with Kriss-Kross super-stropper. If any one goes back on you I'll recondition or replace them free! This sweeping written guarantee solves your blade problem for all time. I mean every word when I say "I'll keep you in Razor Blades for Life."

**Mystery
Razor
FREE!**

Write for Details At Once!

This astonishing offer is limited. Send for information on amazing Kriss-Kross inventions today. They are never sold in stores—and they're even more remarkable than I can tell you here. Clip the coupon today. No obligation.

AGENTS

Make big money as a Kriss-Kross representative. \$75-\$200 a week. Free gift razor is marvelous business booster. We have a unique sales plan that brings you extra profits while you sleep. K. D. Ralph made \$612 in 30 days. H. King took in \$66 one day.

Spare-time workers, office and factory men make \$5-\$10 extra a day just showing Kriss-Kross to friends. Send coupon for details. Check bottom line and mail at once!

RHODES MFG. CO. Dept. C-240
St. Louis, Mo.
Rhodes Mfg. Co.,
Dept. C-240, Pendleton & Cozens Ave.,
St. Louis, Mo.

Please send me without obligation details of your offer to keep me in Razor Blades for life. Also full description of free razor and stropper.

Name.....
Address.....
City..... State.....

How a Million Lights Paint the Gay White Way

(Continued from page 37)

when they climb a little too high on a sign before it is entirely bolted, but when they feel a sign sway beneath their weight, they slide down a few feet to a safer place.

The electricians follow the iron workers, placing the letters and other parts of the sign. Next comes the wiring job, which requires the greatest amount of time of the entire construction. The electric light sockets are already in place on the previously painted letters, which have been cut, bent and punched by machinery out of great pieces of sheet metal. When the wiring is completed, the circuits are tested carefully, and finally the electric lights are screwed in.

All these problems illustrate the tremendous amount of work that goes on behind the scenes of the Gay White Way. When you think of the expense they involve, you can see why the job of the night patrol is so important. Splashing Manhattan nights with gold is a \$20,000,000 industry. Rentals of fifty or a hundred thousand dollars a year are paid for some of the larger signs. In return for the rental, the sign must sparkle unflinchingly from one hour after sunset until 1 o'clock in the morning. If the lights go out, the sign company must pay its client a rebate, which is really a heavy fine for the patrol's failure to keep the sky fires burning.

On this particular evening we had covered the regular street beat and then sought the roof without detecting any trouble.

"Aren't your nights ever more eventful?" I asked.

"Some of us do have odd experiences," my guide admitted. "One of the men once noticed certain lights going out regularly at the same time every night. He would replace the shattered bulbs and perhaps find them broken again before midnight. He couldn't solve the mystery until he played detective, hiding in the shadows of the roof. Then he discovered that some crazy idiot with an air rifle was testing his marksmanship on the sign from a neighboring hotel window.

"Of course in the old days there used to be wild times in these huts, with switches getting stuck, with short circuits, fuses blown out—trouble all the time. A man or a crew was always slaving like the firehold gang on a ship, just to keep the juice flowing. The signs were as unruly as the temperamental prima donnas in the theatre underneath them.

"But nowadays everything works automatically like a charm. Real trouble comes not from a storm like this so much as from a less violent one. Those clear, bright-blue signs up there are lit with 75-watt nitrogen lamps. Each bulb is searing hot to the touch within a few moments after the sign goes on. If a single blob of icy cold snow, or cold rain, hits one of those sizzling bulbs, it may go blooey. In a few minutes, under such conditions, lamps may begin to pop here and there and everywhere and the sign will look as though it had the mange. Fifty per cent

(Continued on page 155)

BE A RAILWAY TRAFFIC INSPECTOR

Earn Up to \$250 PER MONTH
Expenses Paid



More Men Needed

Enter this fascinating, uncrowded profession. Many opportunities; meet big railway officials. Travel or remain near home; healthful, steady, outdoor work.

Position Easily Secured

upon graduation, paying at least \$110 per month and expenses. Any average man can qualify in 3 months—easy spare-time home study.

Advancement Rapid
with experience. Many graduates have found Railway Traffic Inspection the stepping-stone to bigger things and greater earnings.

MUST TRAIN MORE MEN
Positions waiting to be filled. Send coupon today for full particulars and low cost.

Standard Business
Training Institute
Buffalo, N. Y.

Standard Business
Training Institute,
Buffalo, N. Y.

Send me, entirely free,
Booklet No. D-64 giving
full particulars about
course in Railway Traffic
Inspection.

Name

Street

City

Your Choice
\$20.00
Musical Instruments
FREE To Our Students

Your choice of a Violin, Tenor Banjo, Hawaiian Guitar, Banjo, Cornet, Ukulele, Banjo Ukulele, Guitar, Mandolin or Banjo Mandolin. You will be proud to own any one of these instruments and you can have one absolutely free. A few cents a day for lessons is your only expense. Our system of teaching is so easy that you can play several pieces by note with the first four lessons. We guarantee success or no charge. Instrument and lessons sent on one week's free trial. Write for booklet today, no obligation.

CHICAGO CORRESPONDENCE SCHOOL OF MUSIC
Orchard and Willow Streets, Dept. 30, Chicago, Illinois



Easy to Draw Cartoons

When Shown in the RIGHT WAY

Some of the cleverest cartoonists and comic artists learned how to draw in their spare time by following Cartoonist Evans' Simple and Easy to Learn Method and are now MAKING GOOD MONEY. Send one of your drawings, and let Mr. Evans see if you have ability and receive the Portfolio of Cartoons and full details about the course. It is not expensive.

THE W. L. EVANS SCHOOL OF CARTOONING
625 Leader Building Cleveland, Ohio

BE A JAZZ MUSIC MASTER

Play Piano By Ear

Play popular song hits perfectly. Hum the tune, play it by ear. No teacher—self-instruction. No tedious ding-dong daily practice—just 20 brief, entertaining lessons, easily mastered.

At Home in Your Spare Time

Send for FREE BOOK. Learn many styles of bass and syncopation—trick endings. If 10c (coin or stamp) is enclosed, you also receive wonderful booklet "How to Entertain at Piano"—and many new tricks, stunts, etc.

Niagara School of Music
Dept. 902 Niagara Falls, N. Y.

Send for this Free Book

\$100 in Prizes

See Cash Prize Offer on Page
4 in front advertising section

How a Million Lights Paint the Gay White Way

(Continued from page 154)

of the lights may go; but if the hot lamps are sluiced all over with rain, or melting snow, they aren't affected. Of course a bad hailstorm will sometimes smash bulbs right and left.

"When one of us sees that the lights are bursting, there's nothing to do but shin up the face of the sign and replace the exploded bulbs.

"NO, IT isn't particularly risky. Of course, it's a cold and slippery job, crawling around up there like a frozen monkey, and sometimes it's hard, with your numb, gloved fingers, to screw out the stub of the broken lamp. But once that's done, all you have to do is screw in a new one and crawl on to the next shattered socket.

"But the time the golden raindrops on one of the big signs fell upward, and the time the famous kitten was chased by the spool of thread instead of chasing it—those were really accidental maladjustments in the mechanism.

"And some time ago, on a bitter winter evening, I saw that traveling sign up there read, 'On these hot days drink —.'

"That was a mistake in putting on the wrong roll, and was easily fixed. You see, those signs in which an endless sentence races from right to left in a wide frame are operated by a long roll punched with holes like a player-piano roll. The sign itself is solidly dotted with about 2,000 separate lamps in as many separate panels as there are letters visible at one time.

"Inside a hut like this, is the mechanism—a big frame with rollers, over which the punched roll passes until it reaches a panel with as many contact points as there are lights on the sign. Then a set of fingers resting on the traveling strip makes contacts wherever the perforations are.

"The result is that outside on the sign the letter 'A' flashes in the panel at the extreme right, then in the next, and so on until it has apparently moved clear across the sign to the left. All the other letters do the same, so it looks as if the sign itself were traveling. The rolls can be changed in an hour.

"THIS sign is called the motograph. The owner of the invention doesn't have much to do now but sit in an office near here and watch his royalties pile up."

This winter the most complicated "spectacular" in operation on Broadway is a typewriter sign. The typewriter itself as shown on the sign, measures 37 by 57 feet, and performs intricate movements while its messages seem to be typed out on a sheet of paper in letters three and one half feet high.

Few people realize that this is the hundredth anniversary of the illuminated sign. A century ago George Samuel Harris patented, in England, the first illuminated advertising sign—called it the Royal Patent Ambulatory Advertiser. It was mounted on a vehicle and driven through the street. It consisted of oiled placards with candles inside.

\$542⁰⁰ Earned IN ONE MONTH

A Big Money-Making Business

A Business to Enthuse Over—The "Ideal" Lawn Mower Sharpener

A wonderful invention that sharpens lawn mowers scientifically—quickly—perfectly; does the work as nothing else can.

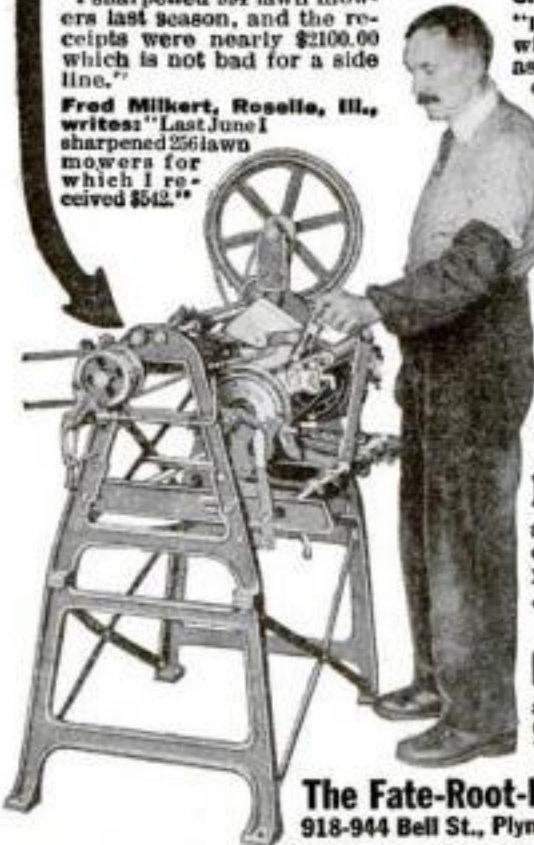
FRED C. MILKERT OF ROSELLE, ILL., WRITES: "The Ideal Lawn Mower Sharpener put me in business, starting in the basement of my home and forcing me now for the third time to move into bigger quarters. Today the dream of my life—a shop of my own—is realized. With a machine like yours and a little hustle any man can have a business of his own and be independent."

W. F. Kendt, Buffalo, writes: "I sharpened 994 lawn mowers last season, and the receipts were nearly \$2100.00 which is not bad for a side line."

Fred Milkert, Roselle, Ill., writes: "Last June I sharpened 256 lawn mowers for which I received \$542."

Zeno Brandon, Middletown, Ohio, writes: "I made \$820.70 in 55 days with my 'Ideal'. Have made as high as \$38.70 in one day."

E. W. McCormick, Saginaw, Michigan, writes: "I have ground over 5,000 mowers during the past five years besides working at my trade."



You Start Now

No town too small. D. S. Newcomer of Vinton, Ia., writes: "People come from miles around and from other towns to have their mowers ground." Lawn mowers are dull—owners don't know where to get them sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing healthful, invigorating and pleasant when mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.

Lawn Mowers Sharpened to Razor Edge

People glad—owners delight in mowing lawn with mower sharpened on an "Ideal". Mowers run light—click-click and the grass is cut. Build permanent business for yourself. Start now!

Write Today

FREE Detailed illustrated catalog and booklet "Let George Say It." Write today.

USE THIS—MAIL IT TODAY

The Fate-Root-Heath Company
918-944 Bell St., Plymouth, Ohio
Please mail at once free illustrated Catalog and Booklet "Let George Say It."

Name _____
Address _____

The Fate-Root-Heath Co.
918-944 Bell St., Plymouth, Ohio



Many Agents Earn
\$100 A Week
Selling Shirts.

Others Earning \$100 Weekly selling direct to wearer. Custom Quality Shirts made by Carlton, 5th Ave., N. Y. America's greatest shirt values, silks, staples and exclusive patterns. We deliver and collect. Your profit: 25% paid daily. Big, beautiful sample outfit FREE. Permanent position. Salesmen and Saleswomen write today for outfit.

CARLTON MILLS, INC.,
98 FIFTH AVE. Dept. A-86 NEW YORK

Class Rings and Pins



Largest Catalog Issued—FREE

Samples loaned class officers. Prices \$2.20 to \$8.00 each. No order for class, society or club emblems too large or too small. Special designs made on request.



METAL ARTS CO., Inc., 7706 South Ave., Rochester, N. Y.

Learn to Mount Birds

Learn at home to mount birds, animals, game heads; tan furs, make rugs and robes. Complete lessons. Easily and quickly learned by men, boys and women.

FREE Write for Free Taxidermy Book. Tells all about it. Every sportsman, trapper and Nature lover should know this wonderful fascinating art. Save your trophies. Big profits. Success guaranteed. 75,000 graduates. Investigate. Write for Free Book. Northwestern School of Taxidermy 1783 Elwood Bldg., Omaha, Neb.

GRANDPA WALKED, FATHER MOTORED, NOW YOU CAN FLY in a LINCOLN SPORT PLANE, 100 miles per hour with 30 H. P. engine.



Send 10c for illustrated catalog.
Blue Prints and Material now ready for Builders! Build your own plane and fly it yourself.
LINCOLN STANDARD AIRCRAFT CORP.
Lincoln, Nebraska

Seal Rupture With a Quarter

Now you can throw away forever steel bands, chafing leg straps, and other heavy makeshift devices. For a well-known American Scientist has found a new, easy way to support rupture assisted by means of a wonderful little invention, weighing less than 1-25 of an ounce. Not only do you do away with the objectionable pressure and tight strapping, but you eliminate the "coming down" of rupture which so frequently leads to strangulation. You can walk, run, exercise, cough with perfect ease.

NEW SCIENCE INSTITUTE

FREE INSPECTION

So great has been the success of this wonderful little device that its inventor is offering to send it to any ruptured person for free inspection. Find out now about this wonderful invention that makes it possible for you to not only support your rupture more securely than ever before, but also makes possible the actual healing of rupture. Write today for free literature and free information of this extraordinary offer.



4022 Clay Street, STEUBENVILLE, OHIO

Money-Making Tools

See
Free
Offer!

I need YOU with 100 firms BEGGING ME to send them more DRAFTSMEN.

Many offer to take BEGINNERS, at \$50 a WEEK. Many Graduates start at \$90 and \$100! GET BUSY!

Drafting is the BIG field, men. Every industry you can name BEGINS with the draftsman. Without mechanical drawings—by the thousands—every shop in the land would be STOPPED.

In fact, it is the SERIOUS SHORTAGE of draftsmen that brings this offer: I will furnish all instruments, supplies, even to the table, to those who start now!

PAY AS YOU GO Don't give me the excuse that you have no ready money for this golden opportunity. I am not so interested in cash; I want your application. I want at least 200 men to start right now. I want them ready to recommend by Spring! We will get a flood of letters saying "send us draftsmen," from every sort of industrial and engineering concern, and we must make good.

The first week's pay envelope of many a Dobe-trained draftsman has held enough to cover the entire cost of the course! Most students learn evenings, keeping on with their old work until ready to step into somebody's drafting room. The first month equips you to take on simple drafting jobs on the side. It helps you learn; I gladly permit this.

Well-Paid Positions Every Way You Turn

A draftsman soon forgets the days when he used to wonder where to get a job. Instead, he asks "What line of work interests me most?" And "What part of the country suits me best?" Twenty of my graduates went to Florida this year; three are in Japan; last month one wrote me from Ceylon. And I wish we had the count of how many Dobe draftsmen have become chiefs!

Positions loom up almost as soon as you are enrolled in a Dobe class! We receive requests daily for junior men—for men only partly through our course. "We'll take a beginner," some concerns write us, "so long as he is a Dobe-trained man and has begun right!"

IT'S EASY and interesting to learn drafting. For drafting isn't "drawing!" You don't need any "talent." A draftsman uses tools for ever, line and every curve. You couldn't make them crooked if you tried! That's why drafting is so easily learned—and so interesting. For you do everything by rule. So, I guarantee to make anyone a finished draftsman; if you can read and write, you can learn this line. One of my students is 51 years old; another is just seventeen. But they'll all be making a grown-up salary by Spring!

WARNING! The special offer of tools is for immediate action. Don't expect me to hold it open indefinitely. Clip the coupon now for free book:

CHIEF DRAFTSMAN DOBE, Div., 13-C3
1951 Lawrence Avenue
Chicago

Special Tool Offer

Send me FREE and POSTPAID Successful Draftsmanship Book and material telling all about your home course, terms, etc.

Name..... Age.....
Address.....
P.O..... State.....

When Ignition Goes Bad

(Continued from page 96)

"Well—let's see," Gus began thinking out loud, as he raised the hood. "Can't be a dead battery because you would never have got it started again once it stopped on you. And it couldn't be dirt in the carburetor because that wouldn't have prevented you from starting with the starter. I wonder what the contact points look like?" he went on, as he snapped the spring hooks off the distributor head and lifted it up.

"Look here, Mr. Morrison," he said. "Here's the clue to the trouble. These points are badly burned. Much more so than they should be from almost any amount of use when everything is all right. I'll bet we find the trouble in the condenser."

"Condenser!" echoed Morrison sneeringly. "Say! What are you trying to put over on me? I wasn't born yesterday. Condensers are those funny things with a lot of plates that move in and out when you turn the dials of a radio set. They don't belong in automobiles."

"THAT kind don't," said Gus, "but there is a condenser in every auto on the road today. Here is yours. It's just a number of layers of tinfoil separated by waxed paper. It is connected across the contact points in the timer; when they are pushed apart by the little cam there, the juice runs into the condenser instead of making a spark across the points."

Gus proceeded to remove the coil, and then he took the two parts to a corner of the workbench where he had a battery fitted with snap terminals, a switch made out of breaker contacts, and a pair of wires sticking up in the air about $\frac{3}{8}$ of an inch apart. He connected everything up so that when he pressed the contact points together and released them, the spark from the coil should have jumped across between the two upper wires.

"Watch, now," directed Gus, as he placed his thumb on the contacts and closed and opened them several times.

"SEEMS all right to me," exclaimed Morrison, as a feeble spark jumped across the gap at the third break of the contact points. "What do you expect—a regular flame?"

"Sure it sparks some!" growled Gus. "It's a darn skinny spark, though, and if you will keep your eye on the contacts here, you will notice that there is a fine, healthy spark between them every time I let go so they can separate. There oughtn't to be hardly any spark at the contacts, and the only reason there is, is because the condenser is on the bum. You know a spark coil makes a spark at the plug because of the sudden stopping of the current flowing through the primary coil by way of the contacts, and if the condenser allows a sort of a miniature arc to take place at the contacts, it lets the current slow down gradually, and you get poor ignition. It worked when you cranked it because the battery voltage was higher when you kept your foot off the self-starter."

(Continued on page 157)

AGENTS NEW SPARK PLUG Visible Flash



Just Out—Amazing Invention—Beacon Lite Spark Plugs. You see the flash of each explosion in the cylinders. Tells which are firing right. Greatest improvement in spark plugs since gas engines were invented. Wonderful gas savers. Agents coining money.

\$90 A WEEK

Made by many agents with new sure-fire plans. Sells on sight to every auto owner. Phillips, Ont., writes "Sold 2 dozen today, 3 dozen yesterday. Rush 10 dozen." Write for special Free Demonstrator Offer and FREE deal to introduce these wonder spark plugs in your territory. Write quick—today.

CENTRAL PETROLEUM COMPANY
1623 Century Building
Cleveland, Ohio

AGENTS \$6 A DAY

taking orders for Non-Alcoholic Food Flavors. Every variety. Put up in collapsible tubes. Always fresh. Three times the strength of bottled flavors. Not sold in stores. Fast repeaters. Big income every day.

Hundreds of Men and Women

Devoting full time can make \$6 to \$20 a day. Big money for spare time. Largest concern of its kind in the world. Over two million dollars' worth of orders taken last year by our representatives for Zanol Food Flavors, Toilet Preparations, Soap, Laundry and Cleaning Specialties and Household Supplies. Every article guaranteed. Write for Sample Outfit and Money Making Proposition.

American Products Co.
5151 American Building, Cincinnati, Ohio



AGENTS Big Money Quick!

COMBINATION KING RADIO WONDER
First combination tube and crystal set ever made. Turn of switch and either tube or crystal works as desired, or both together. 1000 Miles or more on headphones—Load speaker on local. Two complete sets in one for only \$10.95 retail. Get your wonderful money making plan and special price today.
*erial Electric Co.
127-43 W. Kinzie St.
Chicago



Anyone CAN LEARN!
No talent or experience necessary. Fascinating work. Pays big money. Complete instruction book \$1.45. ABOUT: Alphabets, Colors, HOW TO MIX PAINTS, Snow Cards, Window Board and Wall Signs, Ready made letters, folding, TRICKS OF THE TRADE, also gives 100 Alphabets and Designs. Book bound in flexible int. leather, gold edges, and four half bearing Show Card Pens. Book and Pens sent postpaid for \$3.00. (C. O. D. 10c extra.) Ogilvie-Pub. Co., 57 Rose St., Dept. 72, New York

EARN MONEY IMMEDIATELY—WE FURNISH EQUIPMENT TO START

DRAW CARTONS

Turn Your Talent Into Money
Cartoonists earn from \$50 to \$300 per week—some even more. Remarkable new Circle System of Drawing teaches you in half the usual time. Send for booklet and sample lesson plate explaining full details of the course.
THE NATIONAL SCHOOL OF CARTOONING
15 Park Building
Cleveland, Ohio

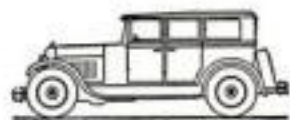
Start a Movie Show
SMALL CAPITAL STARTS YOU Big opportunity to become independent. No experience needed. We show you how. Our easy payment plan makes it easy to start. We equip you completely. Our machines used and endorsed by government institutions. Write today for free catalog.
ATLAS MOVING PICTURE CO.
536 S. Dearborn St., Dept. 71, Chicago

AGENTS 500% PROFIT GENUINE GOLD LEAF LETTERS
Guaranteed to never tarnish. Anyone can put them on stores and office windows. Enormous demand, large profits. Paul Clark says: smallest day \$28.70. R. L. Reel made \$920 in two months. Write today for free sample and liberal offer to general agents.
METALLIC LETTER CO., 433A N. Clark Street, Chicago.





Can You Fix It?



Repair any auto fault, learn how NOW. You can do it easily in this new simple way.

These FIVE Big Books are up to the minute on automobile engineering subjects; chock full of little known facts about construction, operation and repairs. Electric wiring treated in complete detail—illustrations and diagrams make everything clear and easily understood by anybody. The most interesting and most practical set of books ever written on modern automobile engineering. Whether you want to fit yourself for garage owner, repair expert or merely wish to know more about your own car, you will realize the value of these splendidly bound volumes. This is the new 1926 Edition with 70 new and up-to-date wiring diagrams.

No Money Offer

An amazing new plan of distribution brings these books to you for examination without one cent of payment to us. We don't ask a penny of you, but ship the books to you FREE. Look them over—read them as much as you want to; note the splendid photographs and drawings and then if you decide you want them, send us \$2.00; then only \$3.00 a month until only \$19.80 is paid. That is all; nothing more to pay us. If you send NOW we will include

Consulting Membership FREE

Yes, we actually give you a certificate which entitles you to free consultation on any subject related to automobile repairing. 18 specialized experts are at your disposal—ready at any time to help you. With this library and this consultation membership you ought to be able to soon know all there is to be known about autos. Don't miss this special offer. SEND NOW.

AMERICAN TECHNICAL SOCIETY,
Automobile Division A-320, Chicago, Ill.

You may send me your complete Automobile Engineering library, 5 big volumes bound in flexo covers, with the understanding that I am to have ten days to decide if I want to keep them. I will either return them then or send you \$2.00 then and \$3.00 per month until the special low price of only \$19.80 is paid. Send 1926 Edition.

Name.....
Address.....
City..... State.....
Reference.....

When Ignition Goes Bad

(Continued from page 156)

"All right, put in a new one," snapped Morrison. "I'll take your word for it, so don't let's waste any more time palavering about it. I'm in a hurry!"

Joe, who had been listening, ducked into the stock room and reappeared with the proper instrument. Gus fitted it in place, and Morrison, after paying the bill, stepped on the starter and drove out without even a "thank you" to Gus.

"What's the use of being nice to a guy like that?" exclaimed Joe. "All that fine talk about coils and condensers went in one ear and out the other. I'll bet the next time the condenser lets go, he will be stuck again without knowing what the trouble is."

"Never mind," replied Gus. "The old grouch will be around for a complete overhaul job pretty soon if he doesn't take better care of that bus. It's getting awful noisy already."

"BY THE way, Gus," said Joe, "I knew most of that dope you gave him about condensers, but isn't there some way you can tell when a condenser is getting too old and should be replaced?"

"Not that I know of," Gus answered thoughtfully. "That's one of the funny things about condensers. One might last for twenty years, or it might break down completely the day after it was put on the car. Morrison was lucky. His condenser only partly broke down. Most times when a condenser lets go at all it goes dead completely. You may be running along with everything working as fine as silk and then, without any warning, the motor just stops, and, if you haven't a spare condenser in the tool kit, the nearest garage is going to make some money towing your car in."

"Yet lots of fellows think they are prepared for anything in the way of ignition trouble if they have a couple of spare spark plugs tucked away somewhere, and the funny part of it is that you almost never have more than one spark plug go bad at a time, and you can always limp to the next garage on the remaining cylinders."

"ANY time I am going on a long trip," continued Gus, "you can be sure there is a spare condenser in the tool kit as well as a couple of spark plugs and a spare coil, besides a new breaker arm spring and contact points. I never got stuck yet so I couldn't get home."

"Well, condensers are one thing I don't have to worry about on my car, anyway," laughed Joe. "It hasn't got any!"

"Where do you get that stuff?" snorted Gus. "Your confounded puddle jumper has four of them—one in each of the spark coils. But I noticed a spare spark coil in your tool kit and that will take care of coil trouble and bring you home even if you are too dumb to know how it happened."

"Now suppose you put the rest of those guaranteed spark plugs in your tool kit—you ought to be able to get home from most anywheres with all those fine plugs to pick from!" Gus concluded sarcastically.

YOU CAN NOW LEARN HOW TO INVENT!

- How to develop your imagination
- How to develop your ideas
- How to get the facts you need for inventions
- How to keep legal records of ideas
- How to use scientific principles of mechanics
- How to avoid wasting time on impractical inventions
- How to apply for a patent
- How to organize a company
- How to protect your rights
- How to market a patent

and hundreds of other vitally important facts which EVERY successful inventor knows and uses. A remarkable new, and much needed, course which can be studied in spare time, at home.

Make Your Ideas Pay You a Fortune

You can now learn how to train your mind along scientific inventive lines. No longer need you let your mind wander in unprofitable fields. You can learn to think of worth-while ideas and make your ideas pay you money. The trouble with most people is that they do not know what to do with their ideas. Millions of dollars go to waste because of these undeveloped ideas. Now for the first time you can learn to harness your thoughts and make them work for you. One little invention, properly developed, may make you independent for life!

You Are Born an Inventor Develop Your Ability



Raymond F. Yates

Every man, woman and child is born with creative imagination. Some develop this faculty to a greater degree than others, and those who develop it to the greatest extent are successful inventors. Invention is an orderly process of the mind, which combines two or more known facts to produce a new fact. Anyone who develops the right mental process can become an inventor. Every successful inventor has this type of mind, developed by constant experience over a period of perhaps many years. Heretofore those who succeeded in the field of invention had to discover all the principles themselves. But, now, just as any student of medicine, law, or engineering can take full advantage of all the recorded experience in these fields of study, so can YOU take the same kind of short cut to the habits of thought, and the methods of work required of successful inventors.

Says Edison!

"Invention is a Science and Should Be Taught as a Profession."

Every inventor realizes the hopelessness of groping in the dark for the habits of thought and methods of work required for successful invention. Trying to invent without knowing the fundamental requirements of invention is like trying to build a bridge without knowing engineering.

This is the first course in practical invention that has ever been devised. Now you can take Edison's advice and actually learn HOW TO INVENT—how to make invention a profession! In simple, easy-to-understand language, you are told how successful inventors work; you learn how to use the secrets of invention that convert a simple little idea into money.

Amazing Book on FREE Inventive Science

Fortunes have been made by men who have thought of a "little" idea in a flash—the bottle top, the crimped hair-pin, the thin lead automatic pencil, the snap fastener—earned fortunes, yet there are as many fortunes lost by inventors who did not know just what to do about their ideas. A wonderful book explaining this wonderful new course written by 14 practical inventors has been prepared and will be sent free to those genuinely interested. If you have ever had an idea for an invention, or if you would like to become a spare-time or professional inventor, and if you would like to know what to invent, send in your name at once on the coupon or a postal NOW! Only a limited number of these books are available for free distribution.

BUREAU OF INVENTIVE SCIENCE
23 Wisner Bldg. ROCHESTER, N. Y.

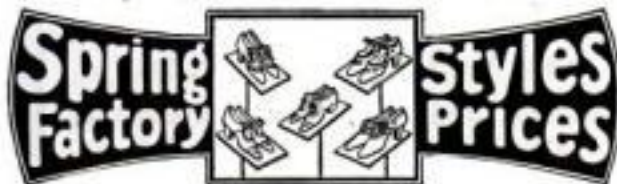
BUREAU OF INVENTIVE SCIENCE,
23 Wisner Bldg., Rochester, N. Y.

Please send me your free book, "The Science of Invention."

Name.....

Address.....

City..... State.....



Agents Wanted

Big Money No Investment

Thousands of dollars income yearly! Enormous market for women's shoes at factory prices! Take orders. Get paid daily. No capital required. We deliver, we fit, we collect. Spring big shoe buying season. Get early start. 35 popular, quick-selling Spring styles in Style-Arch line. Complete range of sizes; widths. Wonderful arch-support and other powerful selling features. Arch-support stops unbearable foot pains caused by falling arches. Great selling point with women of all classes. Let extraordinary spring business line your pockets with plenty money. Hustle! Put in your application for territory today. This highly-successful pioneer company can place a few more good representatives.

STYLE-ARCH SHOE CO. Dept. C-24 Cincinnati, Ohio

Need More Money?



Become a SALESMAN

A successful business executive has said,—"If the average young man will prepare himself to be a salesman, and stick to his work like many of them cling to a small-salaried job, I believe he can make a bigger income and make it quicker than in any other occupation I know of. He doesn't have to be a 'born' salesman; all he needs is a little ambition and the nerve to make a start."

You will be paid only what you are worth in any work. But as a salesman you are not lost in the shuffle; your efforts are individual, they are constantly under the eye of the boss. A business has to have orders—salesmen get them—and they get immediate recognition of increased business. Your income is limited only by your own ability.

NEVER BEFORE Such a Training for Salesmen

Make up your mind that within a year from now you are going to be a salesman. You can do it—hundreds of others are. The common-sense way to prepare yourself is in spare time at home. The Federal Course in Creative Salesmanship brings you a practical training entirely new and different. It not only instructs you in every type and method of selling, but goes far deeper and gives you a wonderful training in memory, concentration, will power, shows you how to analyze and think clearly, and build up your health and energy. It makes you a better man, at the same time you prepare for a big success in selling.

Get this Book "The Vital Spark in Business"

It describes in detail this modern scientific course of sales training. Learn of the master salesmen who have contributed their experience to it, for your guidance. Realize how simple, interesting, and result-producing is the proven Federal method of personal instruction, criticism and coaching. See for yourself the tremendous opportunities in this field, where the good man is constantly sought after. Start now for a bigger income, a successful life, by sending the coupon. State age and occupation.

Federal School of SALESMANSHIP

351 Federal Schools Bldg., Minneapolis, Minn.

Please send your book, "The Vital Spark in Business."

Age.....Occupation.....

Name.....

Write your address plainly in margin

Here Are Correct Answers to Questions on Page 52

1. No. Careful scientific records show no change, at least within the last century or two. Some winters are severe, others are less so.

2. Because the tongue has its nerves much nearer the surface and much more exposed than are the nerves in the skin.

3. So that you can get some idea of distance. When you look at anything, the eyes have to point in slightly different directions so that both shall see the object. If the object is close, the eyes must converge. Your brain perceives, unconsciously, the amount of this convergence. This gives you some idea of how far away the object is.

4. The growth of trees is marked by annual rings in the trunk, and the width of the rings tells us something about the rainfall—the more rain, the wider the ring of growth. Some of the Big Trees of California are 3000 years old. Their growth rings show that at the time of Christ the climate was moister than today.

5. Ancestors of the ostrich have lived for millions of years in countries where ability to run fast was more important than ability to fly. Accordingly, the wings have become useless.

6. No. The rear side never is turned toward us. The moon's axis tips at times and discloses a little more than one hemisphere.

7. A kind of oxygen. The molecules of ordinary oxygen contain two atoms of oxygen each. Ozone, on the other hand, contains three atoms of oxygen.

8. The metal of the spoon absorbs heat. This cools the first part of the liquid so that the glass is not heated quite so suddenly.

9. The conditions that caused the Great American Desert are typical. Rain in the western part of the United States comes mainly from the Pacific Ocean. Close to the ocean is a range of mountains. Farther east is a still higher range. These two ranges cause the moist winds from the Pacific to rise high above the earth. This cools the winds. Most of the moisture then is condensed and falls as rain on the seaward slope of the mountains. Very little water is left in them to provide rain for the land farther east, so this land is desert.

10. No animal corresponding to the sea serpent is known. The many reports of sea serpents may be due to people seeing a school of porpoises following each other.

11. Because it keeps the air away. Without oxygen rust cannot form.

12. To set the muscles in motion and thus increase the flow of blood.



HIGH SCHOOL COURSE IN TWO YEARS

YOU ARE BADLY HANDICAPPED if you lack High School training.

You cannot attain business or social prominence. You are barred from a successful business career, from the leading professions, from well-paid civil service jobs, from teaching and college entrance. In fact, employers of practically all worth-while positions demand High School training. You can't hope to succeed in the face of this handicap. But you can remove it. Let the American School help you.

FIT YOURSELF FOR A BIG FUTURE

This course, which has been prepared by some of America's leading professors, will broaden your mind, and make you keen, alert and capable. It is complete, simplified and up-to-date. It covers all subjects given in a resident school and meets all requirements of a High School training. From the first lesson to the last you are carefully examined and coached.

USE SPARE TIME ONLY

Most people idle away fifty hours a week. Probably you do. Use only one-fifth of your wasted hours for study and you can remove your present handicap within two years. You will enjoy the lessons and the knowledge you will gain will well repay the time spent in study.

Check and mail the coupon NOW for full particulars and Free Bulletin.

American School

Dept. H-375

Drexel Ave. and 58th St., Chicago

American School

Dept H-375 Drexel Ave. & 58th St., Chicago

Send me full information on the subject checked and how you will help me win success.

- | | |
|------------------------------|----------------------------|
|Architect |Business Law |
|Building Contractor |Lawyer |
|Automobile Engineer |Machine Shop Practice |
|Automobile Repairman |Mechanical Engineer |
|Civil Engineer |Shop Superintendent |
|Structural Engineer |Employment Manager |
|Business Manager |Steam Engineer |
|Cert. Public Accountant |Foremanship |
|Accountant and Auditor |Sanitary Engineer |
|Bookkeeper |Surveyor (& Mapping) |
|Draftsman and Designer |Telephone Engineer |
|Electrical Engineer |Telegraph Engineer |
|Electric Light & Power |High School Graduate |
|General Education |Wireless Radio |
|Vocational Guidance |Undecided |

Name.....

Address.....

This One



JZ3W-WDU-W2HZ

Send for this RADIO BOOK FREE

**The World's Largest
Exclusive Radio Mail Order
House Will Send You This
Wonderful Book FREE!**

64 illustrated pages containing thousands of bargains in radio sets, semi-finished sets and radio kits of all styles, sizes and approved circuits. 5-tube sets as low as \$29.50. Beautiful models of the very latest designs and types. Elaborate console models with loud speakers built right in cabinets of genuine mahogany and walnut. All sets guaranteed. Coast to coast receiving range. Also contains everything in radio supplies, including batteries, chargers, loud speakers, transformers, condensers, rheostats and any other parts you may want for improving your set or building a new one. Guaranteed saving to you of $\frac{1}{3}$ to $\frac{1}{2}$.

The Biggest 5-Tube Value on the Market

Positively the world's greatest 5-tube radio bargain. Regular \$75.00 value. Our large quantity production enables us to sell this set for only \$29.50, fully built and wired in beautiful mahogany cabinet of latest design with sloping Bakelite panel of Satin finish, handsomely etched and engraved as illustrated. Constructed of the finest low-loss condensers, coils and sockets. Bakelite baseboard panel and dials. Price for set only.....

Transportation charges extra. Shipping weight 25 lbs.

\$29.50

This set with all Accessories, including the famous American Bell Loud Speaker with adjustable unit, 2-45 volt "B" batteries, one guaranteed 100 Ampere Hour storage "A" battery, cable for battery connection, 5-201A tubes, Aerial and ground equipment, and everything complete ready to set up and operate. Nothing else to buy. Price.....

Transportation charges extra. Shipping weight 100 lbs.

\$59.75



1926 Catalog of RADIO BARGAINS Save $\frac{1}{3}$ to $\frac{1}{2}$

**AMERICAN
RADYNOLA
5 TUBE SET**

\$29.50



Order Direct From This Page! Save $\frac{1}{3}$ to $\frac{1}{2}$. Sets on this page are typical examples of bargains throughout our catalog. Our guarantee protects you. Money cheerfully refunded if you are not satisfied. Write your order and prices plainly. Send post office money order or bank draft for full amount to insure safety. Refer to any bank or commercial agency regarding our reliability.

Columbia Grand 5-Tube Console Set

\$57.95



Console Radio with built-in loud speaker and adjustable unit. Has compartments for storage "A" and "B" batteries, battery charger, radio book of instructions, etc.

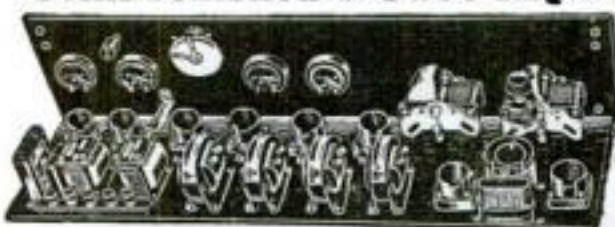
Beautiful Walnut Cabinet in two-toned effect. Two door panels inlaid with highest grade burl walnut. Cabinet is 39 inches high. Top measures 13x37 inches. Equipped with high-grade built-in loud speaker with adjustable unit. Large, roomy interior for holding all batteries, books, etc. The Columbia Grand is a 5-tube tuned radio frequency receiver. Coast to coast receiving range. Tune in stations desired—very selective. Has latest type, low-loss condensers, coils and sockets. Bakelite baseboard, sockets and dial knobs. Dials are beautifully etched in gold on walnut finish bakelite panel. Price for set only, fully built and wired—\$57.95.

Transportation charges extra. Shipped by freight or express.

This set with all accessories, which include 2-45 volt "B" batteries, one guaranteed 100 ampere hour storage "A" battery, 5-201A tubes, multicolored cable for easy battery connection, aerial and ground equipment, instructions for setting up and operating—everything complete, nothing else to buy—\$84.95

Transportation charges extra. Shipped by freight or express.

Semi-Finished 8-Tube Super-Heterodyne



\$43.75

World's Famous 8-tube Super-heterodyne. Fully mounted on panel and baseboard. Comes completely assembled ready to wire and operate. We have testimonials from thousands of builders of this set. Some have received foreign stations on loop aerial. Unsurpassed in volume and tone quality. Low-loss straight line frequency condensers, vernier dials, finest quality rheostats. Matched Columbia long wave transformers. Requires only three screws for attaching panel and baseboard and set is ready to wire and operate. 7x30 panel. Price of set only \$43.75.

Requires following accessories to complete this set: 7x30 cabinet, 8-201A tubes for storage battery operation or No. 199 tubes for dry cell operation, 100 Ampere hour storage battery, 2-45V "B" batteries, loud speaker, center tapped loop aerial. All these items are listed in our catalog, at a tremendous saving.

Our semi-finished sets come with all parts mounted on panel and baseboard ready for wiring. Do not fail to send for our catalog. Remember—we are the largest exclusive radio mail order dealers in the world and carry the best of everything in radio. We save you 1-3 to 1-2 on everything in radio. Detailed descriptions appear in our catalog.

Semi-Finished 5-Tube Radio Frequency Set



This special offer is astounding the radio world. Coast to coast reception on loud speaker. Low-loss condensers and sockets. Highest quality transformers. Bakelite rheostats. All wiring concealed under Bakelite baseboard. 7x18 panel—fits into any standard 7x18 cabinet. Complete instructions for operating. Guaranteed saving to you of \$50.00. Price of set all mounted, \$18.75. Cabinet of same model as American Radynola pictured above \$5.65 extra.

Catalog includes list of broadcasting stations, general radio information and facts about our free service division. Write for it today.

Our line is complete, includes all popular sets, such as Superheterodyne, Neutrodyne, Ultradyne, Reinartz, Regenerative, Radio Frequency, Brown-Drake, Super-Heterodyne Reflex and all other latest circuits. Kits, sets and parts by well-known manufacturers such as Frost, All-American, Thorndarson, Bremer Tully Baldwin Dubilier and Columbia.

ULTRADYNE

Complete parts for 8-Tube Ultradyne receiver, without cabinet, complete with blueprint, instructions and diagrams

\$45.85

NEUTRODYNE

Genuine Licensed Neutrodyne kit of parts come fully assembled on the panel and baseboard with complete instructions ready to wire

\$29.75

ULTRA-AUDION

One-tube Ultra-Audion. Wizard of radio. Fully assembled and ready to wire, with instructions

\$6.35

COCKADAY

3-tube Cockaday kit of parts, fully assembled on panel and baseboard ready to wire

\$15.85

BROWNING DRAKE

4-tube complete low-loss parts

\$32.40

REMLER 8-TUBE SUPER HETERODYNE

Complete parts for Best 45 Kilocycle Super-Heterodyne Genuine Remler parts

\$49.50

HARKNESS

2-tube reflex kit of parts, fully assembled on panel and baseboard, ready to wire, complete instructions

\$16.95

RANDOLPH RADIO CORPORATION
159 N. Union Ave. Dept. 259 Chicago, Illinois

OUR GUARANTEE
Every article exactly as represented. Every article tested before shipping. Complete satisfaction guaranteed.

who tests your tubes?

WHO makes the vacuum tubes you use? is one important question. Who tests them? is another.

The same great research laboratories that developed the MAZDA lamp have developed the Radiotron. The five great factories that manufacture the MAZDA lamp, manufacture the Radiotron. And the same genius and the same scrupulous accuracy are behind the test methods developed for the RCA test laboratories.

You would not think of putting into your lighting socket today, anything but a MAZDA lamp. Why put into your radio socket, anything but an RCA Radiotron—backed by the same skill, the same engineering and manufacturing resources?

A Radiotron is far more difficult to make than an electric lamp. It demands accuracy to the hundredth of an inch. It demands ten million times rarer exhaustion of the air from the tube. And to guard against error in the turning out of hundreds of thousands of Radiotrons—to insure the high standards of uniform perfection that have made famous the names of RCA, General Electric and Westinghouse, the RCA laboratories have developed tests delicately exact. When you buy a vacuum tube—know who made and tested it. Look for the RCA mark and the name Radiotron on the base.

RADIO CORPORATION OF AMERICA
CHICAGO NEW YORK SAN FRANCISCO



RCA-Radiotron

MADE BY THE MAKERS OF RADIOLAS

Ⓢ This seal on a radio or tool advertisement signifies the approval of the INSTITUTE OF STANDARDS. See page 6.

R. H. DUNNELL & SONS CO., PRINTERS, CHICAGO.

Copyrighted material

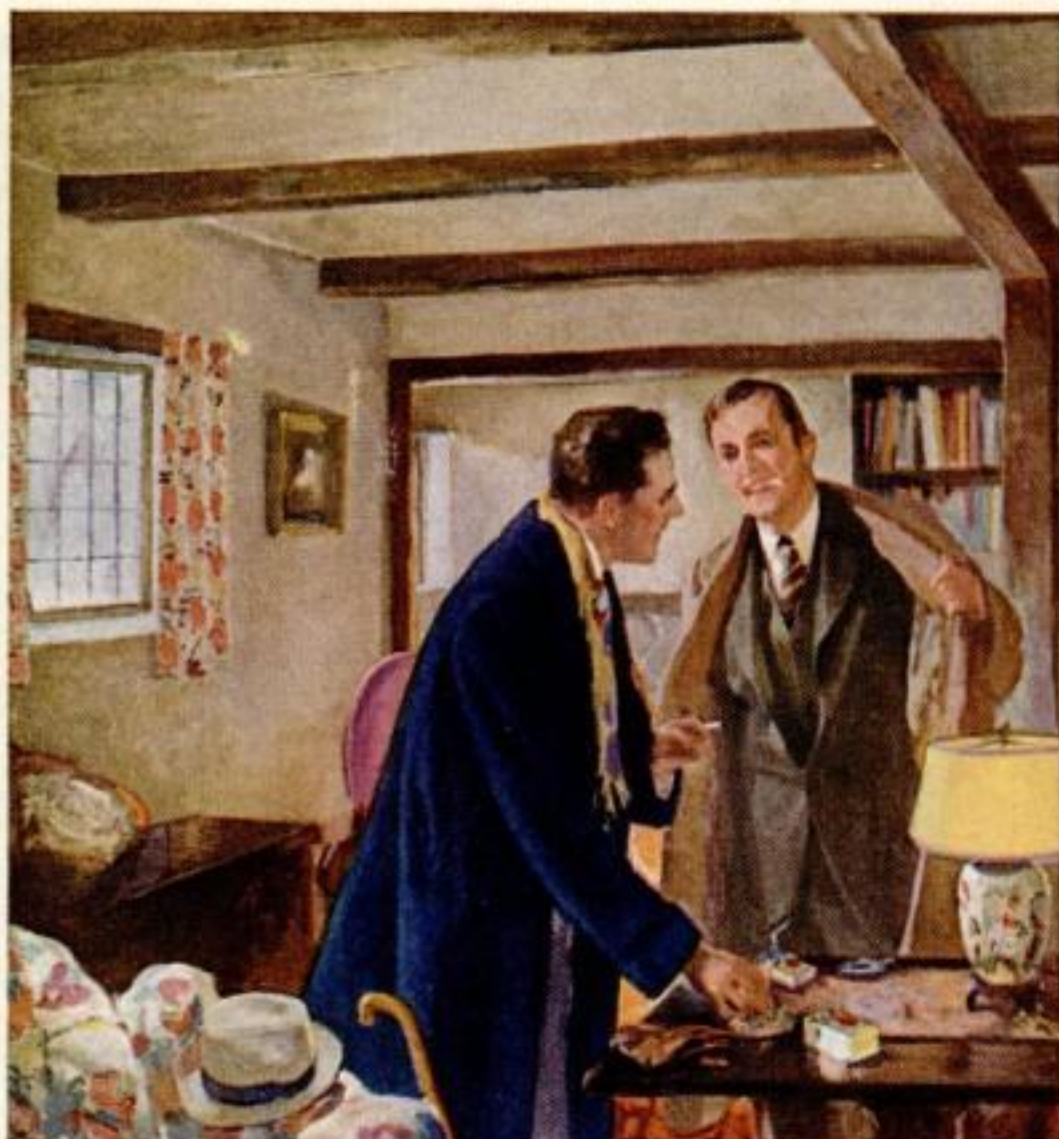


"I can tell that taste
in the dark"

CHESTERFIELD

LIGGETT & MYERS TOBACCO CO.

*When it's a perfect winter day—
and you've just returned from a
tramp in the crisp country air
—when you come in and
find the crackling fire
awaiting you
—have a Camel!*



Into the making of this one cigarette goes all of the ability of the world's largest organization of expert tobacco men. Nothing is too good for Camels. The choicest Turkish and domestic tobaccos. The most skilful blenders. The most scientific package. No other cigarette made is like Camels. No better cigarette can be made. Camels are the overwhelming choice of experienced smokers.

WHEN it's late winter afternoon. And you've just returned with your dogs from a ramble over the hills. When you come inside to your friendly fire—*have a Camel!*

For no other smoke-friend brings back so much cheer and comfort to your fireside as Camel. No other cigarette in the world is welcomed in so many homes. Camels are so skilfully blended that they never tire the taste, or leave a cigaretty after-taste. There's not another cigarette made, regardless of price, that contains choicer tobaccos than those rolled into Camels.

So, on this day, as you start your favorite stroll along the sun-lit hills. As you return and come in to the welcome of your sparkling fire, joyfully know the mellowest fragrance that ever came from a cigarette.

Have a Camel!



Our highest wish, if you do not yet know and enjoy Camel quality, is that you may try them. We invite you to compare Camels with any cigarette made at any price.
R. J. Reynolds Tobacco Company

